

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

ebb phases of the tide respectively. The low silt/clay content of the inlet material should result in relatively low concentrations of suspended sediment outside the immediate area deposition. Estimates of the travel distance and concentrations of suspended sediment during the dike construction (see Figure 6.1 in Appendix B) found that suspended sediment should average around 6 parts per million (ppm) from the dike area to the confluence of the inlet channel with the Eastern Channel and average 4 ppm seaward of the dike. While there is no direct correlation between suspended sediment concentrations and turbidity, the low concentration of suspended sediment indicates that turbidities are likely to remain low during dike construction.

Cumulative Effects. No cumulative impacts on turbidity are expected due to the low suspended sediment concentrations and low silt content of the inlet material. Any increases in turbidity should be limited to the immediate construction area and would be of relatively short duration.

Compatibility with Project Objectives. This alternative supports the project objectives.

#### 5.8.2 Salinity

Alternatives A, B, and C are expected to have the same impacts on salinity as described below.

Direct and Indirect Impacts. Maintenance dredging of the Bogue Inlet channel conducted by the USACE Navigation Branch is not expected to change salinity levels in the area since this activity does not change the hydrodynamics of the inlet.

Cumulative Effects. No cumulative effects on salinity are expected to result from Alternatives A, B, and C.

Compatibility with Project Objectives. Alternatives A, B, and C do not address any of the project objectives.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. During the year, Bogue Inlet has natural fluctuations in salinity ranging from high, transitional, to low depending on tide conditions and antecedent rainfall/runoff conditions. The dimensions of the new channel were selected based on the ability of the new channel to capture the majority of the tidal flow through Bogue Inlet. The minimum cross-sectional area of Bogue Inlet would be slightly less than its historic equilibrium size immediately following construction

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

of the new channel and closure of the existing channel. Within a relatively short period, perhaps 4 to 6 weeks, the cross-sectional area of the inlet should expand to accommodate the normal tidal prism of the inlet. Resumption of the normal tidal exchange will maintain salinity levels in the inlet environment to natural levels. Therefore, no permanent changes in salinity above natural fluctuations are expected to occur from the channel relocation without beach nourishment alternative.

Cumulative Effects. Salinity levels are not anticipated to change as a result of this project and therefore, no cumulative impacts are expected to occur.

Compatibility with Project Objectives. This alternative should not adversely affect salinity in the project area and is therefore, compatible with the project alternatives that address shoreline protection for the Town's western boundary. Use of an offshore borrow site to obtain material for the Phase 3 beach project will not affect salinity in the area.

#### Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. During the year, Bogue Inlet has natural fluctuations in salinity ranging from high, transitional, to low depending on tide conditions and antecedent rainfall/runoff conditions. As with Alternative E, the cross-sectional area of Bogue Inlet will be slightly smaller than its equilibrium size immediately following construction but is expected to rapidly expand and assume its natural cross-sectional area within 4 to 6 weeks after construction with a return of the normal tidal exchange. Therefore, no long-term changes in salinity above natural fluctuations are expected to occur as a result of the channel relocation with beach nourishment alternative.

Cumulative Effects. Salinity levels are not anticipated to change as a result of this project and therefore, no cumulative impacts are expected to occur.

Compatibility with Project Objectives. This alternative is fully compatible with the project objectives.

## 5.9 AIR QUALITY

None of the alternatives would have an impact on air quality.

## 5.10 PUBLIC SAFETY

### Alternative A – No Action

Direct and Indirect Impacts. The erosion of the inlet shoreline would threatened

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

and eventually destroy 36 homes on the west end of Emerald Isle. In response to the threat, property owners would begin to take measures to demolish the threaten buildings and transport the construction debris to sanitary landfills. The activity associated with the demolition could expose workers to risk of injury comparable to similar construction activities. There is also a strong possibility that some hazardous material could fall into the inlet which could pose health threats to people recreating along the inlet. As the erosion undermines existing roads and exposes electrical lines, sanitary systems, and ruptures or requires the relocation and rerouting of the water supply system, the public would be exposed to increased risk of injury and/or infection.

Cumulative Effects. Demolition activities, road undermining, and exposure of utilities would continue as long as the inlet shoreline migrates to the east. The longer the situation exist the higher the risk of personal injury. Raw sewage leaking from exposed septic tanks and the rupture or relocation of the water supply system would increase the risk of disease and infection.

Compatibility with Project Objectives. Project objectives do not directly address public safety. However, the exposure of utilities, particularly sanitary sewer systems, and potable water supplies would greatly compromise public health and safety.

Alternative B – Without Project – Relocate Homes

Direct and Indirect Impacts. The erosion of the inlet shoreline would threaten 36 homes on the west end of Emerald Isle. In response to the threat, property owners would begin to take measures to move the threatened structure to a new location within the town limits of Emerald Isle. The construction activity associated with the structure relocation could expose workers to risks of injury. As the erosion undermines existing roads and exposes electrical lines, sanitary systems, and ruptures or requires the relocation and rerouting of the water supply system, the public could be exposed to increased risk of injury and/or infection.

Cumulative Effects. Demolition activities, road undermining, and exposure of utilities would continue as long as the inlet shoreline migrates to the east. The longer the situation exists the higher the risk of personal injury. Raw sewage leaking from exposed septic tanks and the rupture or relocation of the water supply system would increase the risk of disease and infection.

Compatibility with Project Objectives. Project objectives do not directly address public safety. However, the exposure of utilities, particularly sanitary sewer systems, and potable water supplies would greatly compromise public health and safety.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. The use of sand bag revetments would allow the Town of Emerald Isle more time to respond to threats to the utilities which should reduce the risk of disease and infection from spilled raw sewage and exposure of the potable water supply system, however, the public would still need to boil water prior to use following each rerouting of the potable water supply system. If the shoreline continues to migrate to the east over 10 years, 23 homes would be impacted by the eastward migration of the inlet. While the sandbags would reduce the demolition activities, workers could still be exposed to personal injury risks.

While the public is suppose to stay off of the sand bag revetments, people walking around the inlet shoreline will still be tempted to cross over or walk along the sand bags. The sand bags offer a very slippery surface, particularly when covered with algae or loose sand which greatly increases the risk of falling.

Cumulative Effects. Cumulative effects are expected to be similar to those described in the no action alternative with only a slight reduction in the magnitude of the risk of exposure to health and safety.

Compatibility with Project Objectives. Project objectives do not directly address public safety. However, the exposure of utilities, particularly sanitary sewer systems, and potable water supplies during the 10-year analysis period would greatly compromise public health and safety.

Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. All of the safety and public health safety risks associated with the continued eastward migration of the inlet shoreline described under no action alternative should be eliminated.

Over time, as the ocean shoreline erodes in response to the new channel position, the degree of storm damage protection afforded ocean front property owners on the western 7,500 feet of Emerald Isle could decrease. However, the adjusted shoreline and remaining dune system should still provide adequate protection against damages that would be associated with a storm comparable to Hurricane Floyd of 1999 (see Appendix B).

Cumulative Effects. The general welfare of the property owners in the Pointe subdivision and visitors to the inlet shoreline should greatly improve over existing conditions. Sandbags would no longer be required to protect threatened homes and/or roads so the public would not be exposed to the risk of slipping or falling off of the sand bags.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Compatibility with Project Objectives. The habitat of the inlet area should be restored including the removal of the existing sand bags that pose a risk to people trying to walk around the Pointe shoreline. Septic tanks would no longer pose a risk of polluting the inlet waters when they are exposed and begin to leak.

Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. All of the safety and public health safety risks associated with the continued eastward migration of the inlet shoreline described under no action alternative should be eliminated.

Over time, as the ocean shoreline erodes in response to the new channel position, the degree of storm damage protection afforded ocean front property owners on the western 7,500 feet of Emerald Isle could decrease. However, the adjusted shoreline and remaining dune system should still provide adequate protection against damages that would be associated with a storm comparable to Hurricane Floyd of 1999 (see Appendix B). Also, the inclusion of the eastern 3,000 feet of the affected shoreline area in the Phase 3 beach nourishment project combined with the continued disposal of navigation maintenance material on the extreme west end of Emerald Isle will partially mitigate for the erosive impacts.

Cumulative Effects. The general welfare of the property owners in the Pointe subdivision and visitors to the inlet shoreline should greatly improve over existing conditions. Sandbags would no longer be required to protect threatened homes and/or roads so the public would not be exposed to the risk of slipping or falling off of the sand bags.

Compatibility with Project Objectives. The habitat of the inlet area should be restored including the removal of the existing sand bags that pose a risk to people trying to walk around the Pointe shoreline. Septic tanks would no longer pose a risk of polluting the inlet waters when they are exposed and begin to leak.

## 5.11 AESTHETIC RESOURCES

Alternatives A and B would have the same impacts on aesthetic resources as described below.

Direct and Indirect Impacts. Alternatives A and B would include regular channel maintenance and the use of offshore borrow areas to complete Phase 3 of the nourishment project. Presence of the dredging equipment in Bogue Inlet, as well as, at the offshore borrow site, could temporarily detract from the visual aesthetics of the area. The offshore sand color may be different from the sand color of the beach, and may detract from the aesthetic quality of the beach. This impact, however, would be short-term since the sediments will lighten due to the natural

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

working by sunlight, rain, and wind with time. This so-called “bleaching” effect has been observed along the completed portions of the Bogue Banks beach nourishment project that were constructed with the offshore borrow material.

Cumulative Effects. Alternatives A and B would allow the continuation of erosion on western Emerald Isle, resulting in the loss of existing structures in the Town of Emerald Isle. Loss of these structures would reduce the visual aesthetics of the area. The increase in beach area along the Phase 3 shoreline should result in an overall improved aesthetic quality for the nourished beach.

Compatibility with Project Objectives. Alternatives A and B do not support the project objectives by reducing the effects of erosion along the western shoreline of Emerald Isle. Construction of the Phase 3 beach nourishment project would occur using offshore borrow material that may contain higher concentrations of shell and shell hash compared to the native beach.

#### Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. The installation of sand bag revetments along roadways and homes would provide temporarily protection from erosion. However, the presence of sand bags will likely detract from the aesthetics of the surrounding area.

Cumulative Effects. Sandbags are expected to reduce erosion along the western edge of Emerald Isle; however, erosion could still occur after the permit periods are over and the sand bags have been removed. Erosion is expected continue, leading to the destruction of homes, roads and utilities, all of which could affect the aesthetics of the project area. At the end of the permit period threatened structures would be abandoned and would have to be demolished, which could further detract from the visual aesthetics of the Town. Cumulative effects for the nourished beach would be comparable to the cumulative effects of Alternatives A and B.

Compatibility with Project Objectives. The sand bag revetment alternative is not compatible with the project objectives as they relate to aesthetic resources.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. The aesthetics of the surrounding area of Emerald Isle will be temporarily impacted by the presence of the construction equipment in Bogue Inlet during dredging. After relocation of the channel and demobilization of the construction equipment and the removal of the temporary sandbag revetments, the quality of the aesthetic resources within the project area should improve.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Cumulative Effects. Relocation of the channel, construction of a sand dike, and filling of the existing channel should alter the erosion effects to the western shoreline of Emerald Isle. Thus, the channel relocation without beach nourishment alternative should preserve the aesthetic quality of the Town of Emerald Isle by preventing the destruction of homes along the Pointe subdivision. Since Phase 3 beach nourishment would involve the use of offshore borrow sites, the cumulative effects for the channel relocation without beach nourishment alternative should be similar to the cumulative effects of Alternatives A and B.

Compatibility with Project Objectives. This alternative supports the project objectives related to restoration of the aesthetic resources within the inlet complex, but does not provide for the restoration of the resources within the Phase 3 beach nourishment project area.

#### Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. Direct and indirect effects on aesthetic quality for the channel relocation with beach nourishment alternative should be similar to those for channel relocation without beach nourishment alternative except the existing sandbag revetment may remain in place for up to two years or until such time that the inlet shoreline recovers sufficiently to allow their removal. The use of sand from the inlet for beach nourishment will likely provide sediment that more closely matches that of the original beach sediment, and therefore, differences in sediment coloration and composition are not likely to occur.

Cumulative Effects. Movement of the inlet channel and construction of a sand dike should slow erosion of the eastern shoreline of Bogue Inlet. Therefore, cumulative impacts to aesthetic quality as a result of channel relocation should be similar to those listed for channel relocation without beach nourishment alternative. Thus, increased beach area and restoration of the natural shoreline would result in an overall improved aesthetic quality.

Compatibility with Project Objectives. This alternative is compatible with the project objectives.

## 5.12 RECREATION RESOURCES

Alternatives A, B, and C would have the same impacts on recreational resources as described below.

Direct and Indirect Impacts. The offshore borrow material that would be used to nourish Phase 3 of the Emerald Isle beach nourishment project would probably contain a higher concentration of shell and shell hash similar to the fill material placed on other sections of Bogue Banks. The shell and shell hash tends to

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

accumulate in the area between mean low water and mean high water making walking across the area in bare feet uncomfortable and possibly dangerous due to the possibility of being cut by the sharp edges of the larger shell pieces. This appears to have been the biggest complaint from visitors using the newly nourished sections of Bogue Banks. While the impact does not appear to have been profound, as tourism during 2003 appeared to be strong, if the 2003 visitors experienced an unfavorable experience as a result of the shell, they may elect not to return to Bogue Banks in the future.

The continued erosion of the inlet shoreline would make it impossible to reestablish public access to the inlet shoreline to the same degree that existed in the past. Access from the ocean shoreline to the inlet would require negotiating a rather narrow beach in front of a vertical erosion scarp, in the case of Alternatives A and B, or around the sandbag revetments under Alternative C. In years past, when direct public access to the inlet shoreline was available at the Pointe, the Town of Emerald Isle maintained a public beach access at the end of Inlet Drive that included some parking spaces. The loss of this public beach access was of major concern to residents of all of Emerald Isle who enjoyed the scenic beauty of the inlet, walked along the inlet shoreline, participated in bird watching either individually or in groups, swam in protected waters along the sand spit, or fished in the inlet.

Cumulative Effects. The high shell content of the material used to nourish portions of Bogue Banks could result in future cancellations by visitors to the island. This would have a long lasting impact on the local economy, for even if the beaches eventually recover and return to more natural conditions, the unpleasant experience could take years to overcome before the affected parties are willing to visit Bogue Banks again.

Compatibility with Project Objectives. Alternatives A, B, and C would not provide ideal fill material for completion of Phase 3 of the Emerald Isle beach nourishment project. Public access to the inlet shoreline could not be restored to past conditions resulting in continuing negative impacts on the public's use of the inlet.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. The impacts on recreational resources associated with the use of an offshore borrow area to nourish Phase 3 of the Emerald Isle beach nourishment project would be the same as Alternatives A, B, and C. Public access to the inlet shoreline could be restored to historic conditions allowing the public the opportunity to enjoy the resources in and around Bogue Inlet.

Cumulative Effects. Cumulative effects on visitors to Emerald Isle would be the same as Alternatives A, B, and C for the ocean shoreline. Access to the inlet



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

would be maintained as long as the new channel maintains a position well west of the present shoreline.

Compatibility with Project Objectives. Visitors to the ocean shoreline within Phase 3 may not have the quality experience one would expect if the offshore material has a high shell content. However, the restoration of public access to the inlet shoreline would restore many of the recreational opportunities that residents and visitors to Emerald Isle had come to expect prior to the eastward migration of the inlet channel.

#### Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. The use of the inlet channel material to nourish Phase 3 would create a wider recreational beach with qualities essentially the same as the existing beach. The impact on recreational activities associated with the inlet and inlet shoreline would be the same as Alternative E.

Cumulative Effects. The high quality beach fill along Phase 3 of the Emerald Isle beach nourishment project would have a positive impact on visitors and would encourage their return in later years. Access to the inlet would also provide greater recreational opportunities than presently exists which should also enhance future and repeat visitations.

Compatibility with Project Objectives. The inlet fill material would improve the recreational opportunities associated with the town's ocean shoreline while the restoration of the inlet shoreline access would offer a wide range of recreational outlets for visitors to Emerald Isle.

### 5.13 NAVIGATION

Alternatives A, B, and C would have the same impacts on navigation as described below.

Direct and Indirect Impacts. Alternatives A, B, and C would not have any impact on existing navigation conditions in Bogue Inlet. Under these alternatives, the USACE Navigation Branch would continue to maintain the inlet bar channel using U.S. Government sidecast dredges and possibly a mini-hopper dredge. The USACE Navigation Branch removed an average of 151,500 cubic yards from the channel each year between 1984 and 1999 at an average cost of \$432,000/year. Recently, the dredging amounts and associated costs have increased dramatically with an average of 514,200 cubic yards/year being removed from the channel between 2000 and 2002 at an average cost of \$1,132,000/year. In spite of this rather substantial dredging effort, controlling depths in the channel remain shallower than the authorized depth of 8 feet below mean low water (MLW). This

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

has had a major impact on commercial boating and fishing activity in Bogue Inlet. The rapidly shifting channel requires frequent relocations of the navigation aids by the U.S. Coast Guard. Due to the time required to move the navigation aids, the deepwater channel is often located outside the marked channel corridor requiring current local knowledge to be able to navigate the inlet safely.

Cumulative Effects. Controlling depths in Bogue Inlet will continue to be shallower than the authorized depth of 8 feet below MLW and the channel will continue to shift locations making it unreliable for commercial fishing interests operating out of Swansboro and other nearby ports. The variability of the channel depth and location will also have a continuing negative effect on the recreational use of the inlet.

Compatibility with Project Objectives. None of the goals and objectives for the project address problems and needs associated with navigation in and through Bogue Inlet. However, any action taken to respond to erosion of the Emerald Isle inlet shoreline should not negatively impact navigation in the inlet. Since Alternatives A, B, and C do not involve any changes in the current operation of the inlet by the USACE Navigation Branch, Alternatives A, B, and C would not affect navigation either positively or negatively.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. The dimensions of the centrally located channel, which would have a depth of 13.5 feet below NGVD (15 feet below MLW) and a maximum width of 500 feet across a large portion of the ebb tide delta, would greatly exceed the authorized dimensions of the navigation channel. As a result, the new channel would provide a relatively deep channel for some period of time following its construction. However, even this positive impact is expected to be relatively short lived as estimates of shoaling of the new channel for the case in which the existing channel is artificially filled indicates that controlling depths should again approach 8 feet MLW within 9.5 months after construction. On the positive side, the USACE Navigation Branch could suspend maintenance dredging in the inlet during the channel construction period and for the 9 to 10 months following completion of the channel. Based on recent dredging costs in Bogue Inlet, this could save the USACE Navigation Branch approximately \$1.0 million.

Navigation in the inlet would be impacted for a brief period during the construction of the new channel primarily during the time the sand dike is being constructed across the existing channel. Construction of the sand dike is expected to take less than 10 days, however, once the new channel is completed, new navigation aids would have to be installed along the new channel alignment. The total amount of time Bogue Inlet would likely be closed to navigation would be approximately 30 days. Since construction of the new channel is scheduled for November 2004 to

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

March 2005, closure of the inlet to navigation should occur during a period when navigation activity in the inlet is normally low.

Cumulative Effects. After about 9 to 10 months following the relocation of the inlet channel, maintenance dredging by the USACE Navigation Branch would resume. With the resumption of the normal maintenance activities, future channel conditions would not differ substantially from past conditions, i.e., controlling depths will continue to be less than 8 feet MLW most of the time and the position of the channel would continue to change.

Compatibility with Project Objectives. The channel relocation would negatively impact navigation in Bogue Inlet for approximately 30 days during the winter or early spring. Following this brief interruption, navigation through the inlet would return to normal and could actually be improved for 9 to 10 months after completion of the new channel.

Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. The dimensions of the new channel would be the same as under Alternative E, however, since the existing channel would not be completely closed, the existing channel would capture some of the littoral material moving into the inlet from Emerald Isle. This would slow the rate of shoaling of the new channel, increasing the period of time in which controlling depths remain at or below 8 feet MLW to around 12 months following completion of the new channel. The suspension of maintenance dredging by the USACE Navigation Branch during the channel construction period and for 12 months following channel completion could save the USACE over \$1.4 million in dredging costs.

Preferred Alternative F also involves the construction of a sand dike across the existing channel which, like Alternative E, would close the channel to navigation for a total period of about 30 days. Again, this closure should occur in the winter or early spring and should not impact commercial and recreational boating interests who normally use the inlet.

Cumulative Effects. The new channel should maintain depths equal to or greater than 8 feet MLW for at least 12 months following construction after which normal maintenance dredging by the USACE Navigation Branch would resume. Accordingly, there would not be any long term impacts of the project on navigation.

Compatibility with Project Objectives. The channel relocation would negatively impact navigation in Bogue Inlet for approximately 30 days during the winter or early spring. Following this brief interruption, navigation through the inlet would return to normal and could actually be improved for 12 months after completion of

the new channel.

#### 5.14 HISTORIC PROPERTIES AND CULTURAL RESOURCES

Cultural resources investigations of Bogue Inlet include magnetometer and side-scan sonar surveys. Three magnetic anomalies were detected, one on the east side of the existing channel at a point approximately 1,600 feet north of Inlet Drive, or in the general vicinity of the sand dike proposed for Alternatives E and F, and two in the central portions of the ebb tide delta in the area of the proposed channel under Alternatives E and F. The two anomalies in the channel area were relatively small and believed to be modern debris such as a crab trap, anchor, or pipe and are not historically significant, and the anomaly located in the vicinity of the proposed dike was not believed to be of historic significance. The study concluded that no further investigations are needed. A copy of these investigations (Appendix H) was sent to the USACE, Wilmington District office on July 25, 2003 for distribution to the State Historic Preservation Officer for review.

Alternatives A, B, and C would have the same impact on historic properties and cultural resources as described below.

Direct and Indirect Impacts. No direct or indirect impacts to historic properties or cultural resources are expected from implementation of Alternatives A, B, and C. Cultural resource investigations have been conducted on the offshore borrow sites identified for use in the Phase 3 beach nourishment and no impact to submerged cultural resources is expected to result from the use of the borrow sites. Refer to Appendix A Subpart 2, letter from David Brook (NCDCCR) to Samuel Jolly (USACE, Wilmington District) dated October 27, 2003.

Cumulative Effects. No cumulative impacts on cultural resources are expected from Alternatives A, B, or C.

Compatibility with Project Objectives. Alternatives A, B, and C are not compatible with the project objectives.

Alternatives E and F would have the same impact on historic properties and cultural resources as described below.

Direct and Indirect Impacts. No direct or indirect impacts to historic properties or cultural resources are expected from implementation of the channel relocation without beach nourishment alternative since cultural resource investigations in the inlet did not identify any anomalies of potential historic significance. Cultural resource investigations have been conducted on the offshore borrow sites identified for use in the Phase 3 beach nourishment and no impact to submerged cultural is expected to result from the use of the borrow sites. Refer to Appendix A Subpart

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

2, letter from David Brook (NCDCCR) to Samuel Jolly (USACE, Wilmington District) dated October 27, 2003.

Cumulative Effects. None.

Compatibility with Project Objectives. Alternative E is compatible with the project objectives, but does not provide for the use of the high quality inlet material to be used for nourishment of the Phase 3 project shoreline. Preferred Alternative F is compatible with all project objectives.

## 5.15 SOCIO-ECONOMIC

### Alternative A – No Action

Direct and Indirect Impacts. Under the no action alternative, losses in revenue to Emerald Isle and Carteret County could occur due to the immediate loss of seven threatened homes and land along western Emerald Isle. The tax value of real property located within the area that could be impacted by continued inlet shoreline erosion over the 10-year period totals almost \$11.0 million. Households displaced by the inlet erosion could have a direct impact on the economy of the area due to reduced spending. A summary of the economic impact of Alternative A is provided in Section 5.23.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Cumulative Effects. Nourishment of the beach along Emerald Isle using offshore borrow sites should provide a reduction in impacts from hurricanes and storms within the project area. However, if erosion of the Emerald Isle inlet shoreline is allowed to continue, additional structures, including roads and utilities, may be threatened and there will be incidental repercussions to tourism and the local economy. The loss of tax revenue and household spending would accumulate over a period of at least 10 years or as long as the inlet shoreline continued to migrate to the east.

Compatibility with Project Objectives. This alternative does not support the project objectives.

Alternative B – Without Project – Relocate Homes

Direct and Indirect Impacts. Under this alternative, the tax revenue for the relocated structures would be preserved, however, the overall tax base for Emerald Isle and Carteret County could be reduced with the loss of the abandoned lots in the Pointe subdivision. The continued erosion of the Emerald Isle inlet shoreline may affect roads and utilities in the area, which could lead to incidental repercussions to the local economy. A summary of the economic impact of Alternative B is provided in Section 5.23.

Cumulative Effects. If erosion is allowed to continue, the cumulative effects for the relocate homes alternative could include the cumulative effect of lost tax revenue for lots lost or abandoned in the Pointe subdivision.

Compatibility with Project Objectives. This alternative does not support the project objectives.

Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. Sand bag revetments would provide temporary protection from the erosion occurring on the western edge of The Pointe. Since the sandbags are permitted for a limited amount of time, erosion of the Pointe would continue but at a reduced rate. The erosion could result in the permanent loss of the tax value of structures and lots as well as result in a reduction of household spending. A summary of the economic impact of Alternative C is provided in Section 5.23.

Cumulative Effects. State rules allow sand bags protecting homes to be in place for a period of two years and those protecting roads to be in place for five. Installation of sand bags should slow the rate of inlet shoreline erosion to the east but eventually homes, roads, and utilities could be lost by continued erosion. Loss of these structures would result in losses in revenue to Emerald Isle and Carteret

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

County and could possibly negatively affect tourism to the area. Nourishment of Emerald Isle beaches would still occur under this alternative, therefore, the cumulative effects concerning nourishment will be comparable to those listed for the no action alternative.

Compatibility with Project Objectives. This alternative does not support the project objectives.

Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. The relocation of the channel and filling of the existing channel should eliminate the immediate erosion threat to structures and infrastructure in the Pointe subdivision for at least 15 years and possibly 35 years depending on the stability of the relocated channel. This would preserve the tax base of Emerald Isle and Carteret County and would maintain household spending. Since Alternative E would deplete the funds presently available for nourishing Phase 3 of the beach nourishment project, the Town of Emerald Isle would probably have to delay construction of Phase 3 for 2 years while it develops the financial capability to accomplish the work. A summary of the economic impact of Alternative E is provided in Section 5.23.

Cumulative Effects. The channel relocation should provide long-term protection of 31 to 51 homes and Town infrastructure over the next ten years by reducing erosion rates along The Pointe shoreline. Protection of these structures will maintain the Town's tax base. The eventual construction of Phase 3 should provide an improved recreational beach and an increased level of storm damage protection.

Compatibility with Project Objectives. This alternative is compatible with the project objectives.

Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. The relocation of the channel should eliminate the immediate erosion threat to structures and infrastructure in the Pointe subdivision for at least 15 years and possibly 35 years depending on the stability of the relocated channel. This would preserve the tax base of Emerald Isle and Carteret County and would maintain household spending. Preferred Alternative F would allow the Town of Emerald Isle to immediately complete the construction of the Phase 3 beach fill without having to arrange for additional financing. A summary of the economic impact of Preferred Alternative F is provided in Section 5.23.

Cumulative Effects. Effects on the Pointe subdivision are anticipated to be the same as the cumulative effects described for the channel relocation without beach

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

nourishment alternative. The Town of Emerald Isle would not have to arrange additional financing to accomplish Phase 3 of its nourishment project.



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Compatibility with Project Objectives. This alternative is completely compatible with the project objectives.

## 5.16 LAND USE

Alternatives A, B, and C would have similar impacts on land use as described below.

Direct and Indirect Impacts. Erosion of the inlet shoreline over the next 10 years would affect land use within the Town of Emerald Isle in general and the Pointe subdivision specifically. Once properties are lost to erosion, the land use opportunities associated with those areas will probably change to reflect the owner's inability to develop them for residential use. Further development or reclamation of the property would likely be limited or prohibited by local, state, and Federal regulations.

Cumulative Effects. The cumulative effects could result in the loss of residential and public recreational land uses within the Town of Emerald Isle. The economics and related impacts from implementation of the no action alternative are addressed in Section 5.23.

Compatibility with Project Objectives. Alternatives A, B, and C do not support the project objectives.

Alternatives E and F will have similar impacts on land use as described below.

Direct and Indirect Impacts. Channel relocation without beach nourishment should result in an increase in recreational opportunities and a preservation of the at risk homes by altering the erosion patterns currently impacting the eastern shoreline of Bogue Inlet. Upon completion of the sand dike and infilling of the existing channel either directly under Alternative E or indirectly under Alternative E, additional recreational land uses should be available to the residents and visitors of Emerald Isle.

Ownership of any new land that accretes on the west end of Emerald Isle would revert to the adjacent upland property owners according to an Advisory Opinion rendered by NC Attorney General's office.

Cumulative Effects. Under both Alternative E and F, a considerable amount of new land is expected to accrete off the west end of Emerald Isle. Ownership of this new land would vest with the adjacent upland property owners. However, in response to resource agencies concerns over the future use of the accreted lands and the need to develop effective bird management plan, the Town of Emerald Isle

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

has initiated efforts to obtain ownership to any new land that accretes west of the historic property lines of the affected properties on the west end of Emerald Isle. The Town has tentative verbal approval from the affected property owners to deed such accreted land to the Town of Emerald Isle and is in the process of drawing the legal documents that will formalize the land transfer. Also, the Town will seek quitclaim deeds from the original developers of the Pointe subdivision who still own the northern areas of the existing sand spit. Conservation easements will be placed on the land deeded to the Town and any future land that accretes west of the existing property lines to prevent potential future development and facilitate the implementation of a bird management plan. The Town of Emerald Isle has also initiated a legislative process that will allow the extension of the town boundaries west to the Bogue Inlet mean high water shoreline.

Compatibility with Project Objectives. Alternatives E and E are compatible with the project objectives as they relate to land use.

## **5.17 HYDRODYNAMICS**

### **5.17.1 Tides and Tidal Flow**

Alternatives A, B, and C would not have any significant direct, indirect, or cumulative impacts on existing tides and tidal flow in Bogue Inlet.

Alternatives E and F would have the same impacts on tides and tidal flow as described below.

Direct and Indirect Impacts. Construction of the new channel and closure of the existing channel with the construction of the sand dike could briefly impact flows in Bogue Inlet during the adjustment period of the new channel. Model tests conducted for the channel relocation alternatives (see Appendix B) indicated a 17% reduction in tidal flow through the inlet immediately following channel construction and closure of the existing channel. Over a relatively short period of time (perhaps 4 to 6 weeks) the new channel will undergo scour as it adjust to the new flow regime. The scour of the new channel should restore the cross-sectional area of Bogue Inlet to its equilibrium value resulting in a return of the normal tidal exchange or tidal prism of the inlet.

Cumulative Effects. Following the 4 to 6 week adjustment period, the new channel should take on natural characteristics and tidal flow through Bogue Inlet should return to normal. The resumption of the normal tidal exchange would maintain existing tide levels and tide ranges in the sound.

Compatibility with Project Objectives. The tides and associated tidal flow through Bogue Inlet should return to normal following a brief period of adjustment which

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

should serve to maintain the habitat of the inlet adjacent sound areas.

### 5.17.2 Waves

Alternatives A, B, and C would have similar impacts on waves as described below.

Direct and Indirect Impacts. The eastward migration of the inlet channel would continue to push the east side of the inlet's ebb tide delta toward Emerald Isle with the resulting wave refraction patterns around the east portion of the ebb tide delta contributing to the continued accretion of the ocean shoreline along the west end of Emerald Isle. Some of the positive impacts along the ocean shoreline would be offset as the eastward migration of the channel would eventually begin to impact properties along the ocean front.

Cumulative Effects. The eastward migration of the inlet channel and the associated eastward movement of the ebb tide delta could result in the inlet impacting sections of Emerald Isle farther to the east as wave refract and diffract around the ebb tide delta. The zone of influence of the wave refraction patterns around the ebb tide delta directly impacts approximately 3,000 feet of shoreline immediately east of Bogue Inlet with secondary impacts, in the form of accretion, reaching 7,500 feet east of the inlet.

Compatibility with Project Objectives. The wave refraction pattern around the existing ebb tide delta has resulted in the formation of the distinct bulge in the shoreline immediately east of the inlet. This bulge should migrate east as the inlet channel continues to migrate to the east. While the impacts would be positive for the sections of the shoreline within the direct wave shadow zone of the delta and for some distance east of the shadow zone, the erosion associated with the eastward movement of the channel would begin to directly impact properties located along the ocean shoreline. This could have a negative impact on the town and county tax bases.

Alternatives E and F would have similar impacts on waves as described below.

Direct and Indirect Impacts. The relocation of the inlet channel should result in a restructuring of the ebb tide delta of the inlet with the east side of the delta shifting approximately 3,000 to 3,500 feet to the west. This would move the impacts of wave refraction around the ebb tide delta a comparable distance to the west exposing the west end of Emerald Isle to the direct wave attack. The 3,000-foot to 3,500-foot westward shift of the delta would position the west side of the ebb tide delta immediately off the east end of Bear Island and should result in wave sheltering along that section of the island. The accompanying wave refraction pattern around the newly positioned ebb tide delta could eventually cause the development of a shoreline bulge comparable to that presently existing on the west end of Emerald Isle. The wave refraction pattern around the ebb tide delta on the Bear Island side should provide some wave sheltering immediately to the west of

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

the delta which could contribute to the accretion of the shoreline on the east end of Bear Island.

Cumulative Effects. The new channel is expected to maintain a certain degree of stability for at least 15 and perhaps 35 years. As long as the ebb tide delta and the associated wave refraction patterns remain in this location, the east end of Bear Island should be positively impacted by the reduction in exposure to direct wave attack.

Compatibility with Project Objectives. The development on the west end of Emerald Isle would eventually be exposed to direct wave attack as the ebb tide delta adjusts to the new channel location. The wave exposure could increase the risk of damage to ocean front structures during severe storms. However, the width of beach and size of dunes that would remain on the west end of Emerald Isle following the channel relocation appear to provide a higher degree of protection than that which presently exists along most sections of Emerald Isle (see Appendix B).

#### 5.17.3 Littoral Transport

Alternatives A, B, and C would have similar impacts on littoral transport as described below.

Direct and Indirect Impacts. Littoral transport on the west end of Emerald Isle east of the influence of Bogue Inlet is predominantly to the west with the net transport averaging 272,000 cubic yards/year to the west. The gross rate of transport, i.e., the sum of material moving to the east and west, averages 863,000 cubic yards/year. In the area immediately east of Bogue Inlet that is influenced by the inlet's ebb tide delta, the net rate of sediment transport appears to be near zero as evidenced by the relative stability of that section of the shoreline (see Appendix B).

Under Alternatives A, B, and C, Phase 3 of the Emerald Isle beach nourishment project would be nourished with material obtained from an offshore borrow area. The design template for the beach fill would add a net of approximately 35 cubic yards of fill material per foot of shoreline. This should increase the width of the dry beach approximately 80 feet immediately following construction with the net increase in dry beach adjusting to around 40 feet within a few months following placement. The main fill for Phase 3 would end approximately 6,500 feet east of Bogue Inlet while the 2,000-foot western taper section would extend the fill to within 4,500 feet of the inlet. The west end of the Phase 3 fill including the taper section would be located in an area where the width of the existing beach is relatively wide and net sediment transport rates are near zero as a result of the wave refraction patterns around the existing ebb tide delta. Consequently, sediment transport off the west end of the fill should not differ significantly from

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

the existing rates in the area and would therefore not have any impact on shoaling in Bogue Inlet.

Cumulative Effects. Alternatives A, B, and C would not impact the future rates of littoral transport except in those areas influenced by the eastward migrating ebb tide delta.

Compatibility with Project Objectives. The littoral transport regime in the vicinity of Bogue Inlet would remain unchanged and would therefore not have any impact, positive or negative, on project goal and objectives.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. The movement of the inlet channel and concomitant reformulation of the inlet's ebb tide delta to the west should result in net sediment transport rates along the west end of Emerald Isle increasing from its present value estimated to be close to zero to a rate comparable to the net rate applicable for the shoreline east of the influence of the inlet, i.e., a rate approaching 272,000 cubic yards/year to the west. This increase in the net rate of transport should occur over a period of 8 to 10 years as the ebb tide delta of Bogue Inlet and the shoreline on the west end of Emerald Isle adjusts to the new channel position. The adjustment of the shoreline could result in the erosion of approximately 565,000 cubic yards from the shoreline west of Spinnaker's Reach to Bogue Inlet.

The main portion of the Phase 3 fill and the 2,000-foot taper section would extend into the east portion of the 7,500-foot shoreline segment predicted to be impacted by the relocated channel and would add approximately 70,000 cubic yards of fill material to the shoreline in the impact area. The relatively small increase in beach width associated with the Phase 3 fill combined with the 2,000-foot taper section should not have a significant impact on net sediment transport rates off the west end of the fill. Over the 8 to 10 year shoreline adjustment period, net sediment transport near the west end of the Phase 3 fill will gradually increase from near 0 to 272,000 cubic yards/year. The sediment eroded off the west end of Emerald Isle, including the Phase 3 fill, and the material transported landward from the abandoned portion of the Bogue Inlet ebb tide delta should be transported into Bogue Inlet and contribute to the development of the sand spit off the west end of Emerald Isle as well as contribute to shoaling of the relocated channel. Since the existing channel will be filled under Alternative E, the rate of spit development should be relatively rapid with the spit expected to merge with the sand dike within 2 years of the channel relocation. The direct filling of the existing channel could also contribute to higher rates of shoaling in the relocated channel with controlling depths in the new channel decreasing to around 8 feet below MLW within 9 to 10 months after construction.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

On Bear Island, sediment transport to the east along the east end of the island should decrease in response to the new location of the inlet ebb tide delta and associated shoreline bulge that would form immediately west of the inlet. The reduction in east transport would retain sediment along the ocean shoreline contributing to the eventual accretion of the east portion of the island.

Cumulative Effects. Near the end of the 8 to 10 year shoreline adjustment period, sediment transport along the west end of Emerald Isle, from the west terminus of the Phase 3 fill to Bogue Inlet should be rather uniform averaging around 272,000 cubic yards/year. This should result in the shorelines closer to the inlet behaving in a manner similar to the shorelines located farther to the east. As a result, shoreline changes close to the inlet should moderate with annual recession rates approaching 1 to 2 feet per year.

Sediment transport from Bear Island into Bogue Inlet should be reduced with the sediment being retained along the ocean shoreline. The retention of this sediment on the ocean shoreline should eventually result in Bear Island accreting close to 500 feet near Bogue Inlet to around 100 feet 7,500 feet west of the inlet (see Appendix B).

Compatibility with Project Objectives. The movement of the abandoned ebb tide delta material and the accumulated littoral material on the west end of Emerald Isle into Bogue Inlet would serve to enhance the development of the new sand spit off the west end of Emerald Isle. This should result in the restoration of the inlet to a condition comparable to that which existed in the late 1970's to early 1980's.

#### Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. Changes in littoral transport on the west end of Emerald Isle would be essentially the same as that described for Alternative E. Since the inlet material would be used to nourish Phase 3 of the Emerald Isle beach nourishment project, residual currents in the existing channel could result in the onshore movement of material from the abandoned ebb tide delta taking slightly longer than Alternative E; however, the sand dike is expected to effectively reduce the flow in the existing channel to near zero so the onshore movement of the ebb tide delta material should still occur in a time frame comparable to Alternative E. The width of the Phase 3 fill will be slightly less than the width of the fill under Alternative E, however, the narrower width should not result in any significant differences in sediment transport off the west end of the fill compared to Alternative E. Material moving off the west end of Emerald Isle and onshore from the abandoned portion of the ebb tide delta should deposit in the existing channel in the form of a recurved sand spit that should eventually merge with the sand dike. The time required for the sand spit to merge with the sand dike would be 4 to 6 years. Also, since some of the material moving off the west end of Emerald Isle would be intercepted by the existing channel, shoaling rates in the new channel

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

should be slightly less until the existing channel is completely filled. The time required for controlling depths to reach 8 feet MLW would be 12 months compared to the 9 to 10 months for Alternative E.

Cumulative Effects. Near the end of the 8 to 10 year shoreline adjustment period, sediment transport along the west end of Emerald Isle, from the west terminus of the Phase 3 fill to Bogue Inlet should be rather uniform averaging around 272,000 cubic yards/year. This would result in the shorelines closer to the inlet behaving in a manner similar to the shorelines located farther to the east. As a result, shoreline changes close to the inlet should moderate with annual recession rates approaching 1 to 2 feet per year.

Sediment transport from Bear Island into Bogue Inlet should be reduced with the sediment being retained along the ocean shoreline. The retention of this sediment on the ocean shoreline should eventually result in Bear Island accreting close to 500 feet near Bogue Inlet to around 100 feet 7,500 feet west of the inlet.

Compatibility with Project Objectives. The movement of the abandoned ebb tide delta material and the accumulated littoral material on the west end of Emerald Isle into Bogue Inlet should serve to enhance the development of the new sand spit off the west end of Emerald Isle. This should result in the restoration of the inlet habit to a condition comparable to that which existed in the late 1970's to early 1980's.

## 5.18 INFRASTRUCTURE

Alternatives A and B would have the same impacts on infrastructure as described below.

Direct and Indirect Impacts. Erosion of the inlet shoreline over the next 10 years could affect the infrastructure that serves the Pointe subdivision. Once a portion of a utility service line or road is threatened, the Town of Emerald Isle would have to disconnect and reroute service lines and modify traffic and access to alternate routes to serve remaining properties. Since the migration of the inlet shoreline would be progressive, the Town would have to make numerous responses to emergencies affecting the infrastructure system over the next 10 years. Disconnecting and rerouting the utility service system and access provision would necessitate ongoing planning and response to loss of infrastructure in the western portion of the Town. The economic impact associated with the loss of infrastructure under Alternatives A and B is provided in Section 5.23.

Cumulative Effects. The uncontrolled eastward migration of the inlet shoreline over the next 10 years would continue to impact roads and utilities in the Pointe subdivision. A summary of the economic impact of the inlet shoreline erosion on infrastructure is provided in Section 5.23.



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Compatibility with Project Objectives. Alternatives A and B are not compatible with the project objectives.

Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. Erosion of the inlet shoreline over the next 10 years could affect the infrastructure that serves the Pointe subdivision. Once a portion of a utility service line or road is threatened, the Town of Emerald Isle would have to disconnect and reroute service lines and modify traffic and access to alternate routes to serve remaining properties. Since the migration of the inlet shoreline would be progressive, the Town would have to make numerous responses to emergencies affecting the infrastructure system over the next 10 years, however, the number of responses should be reduced by the installation of the sandbag revetments. Disconnecting and rerouting the utility service system and access provision would necessitate ongoing planning and response to loss of infrastructure in the western portion of the Town. The economic impact associated with the loss of infrastructure under Alternative C is provided in Section 5.23.

Cumulative Effects. The eastward migration of the inlet shoreline over the next 10 years would continue to impact roads and utilities in the Pointe subdivision. A summary of the economic impact of the inlet shoreline erosion on infrastructure is provided in Section 5.23.

Compatibility with Project Objectives. The sand bag revetment alternative does not support the project objectives.

Alternatives E and F would have the same impact on infrastructure as described below.

Direct and Indirect Impacts. Relocation of the inlet channel should have immediate direct and indirect impacts on the infrastructure at the Point by altering the erosion trends of the inlet shoreline. Infrastructure in the area should be protected from impacts resulting from inlet shoreline loss.

Cumulative Effects. Cumulative effects associated with the channel relocation include the preservation of existing infrastructure in the area and elimination of the need to expend additional Town resources to address infrastructure loss at the Pointe.

Compatibility with Project Objectives. Alternatives E and F support the project objectives.

## 5.19 WATER COLUMN

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**5.19.1 Marine**

Alternatives A, B, and C would have the same impacts on the marine water column as described below.

Direct and Indirect Impacts. Alternatives A, B, and C would result in regular channel maintenance by the USACE Navigation Branch and the use of an offshore borrow area to complete the Phase 3 beach nourishment project. The potential effects to the marine water column from maintenance dredging include an increase in sedimentation during dredging, which stresses the growth and reproductive energies of benthic organisms, and an increase in turbidity, which reduces the penetration of light, required by photosynthetic organisms found in the water column. Maintenance dredging involves the discharge of dredged material into the open waters of Bogue Inlet. Thus, water quality within the water column would also be impacted by the discharge of sediment into the inlet, which could lead to a decrease in the quality of marine water column resources. Offshore dredging from a borrow site would also lead to increases in turbidity and sedimentation within the marine water column.

Cumulative Effects. Cumulative impacts on the marine water column may occur if sedimentation and turbidity levels are high or maintained for long periods of time, making the water column uninhabitable. Considering that the material relocated during maintenance dredging activities contains a low percentage of silt, long-term effects to the marine water column are not anticipated. Depending upon the characteristics of the offshore borrow site selected for use in the Phase 3 project, there may be an effect on the marine water column during project construction, but these effects are not expected to be cumulative.

Compatibility with Project Objectives. Alternatives A, B, and C do not support the project objectives to relocate the inlet channel to the center of the inlet complex or provide beach quality material for restoration of the ocean shoreline within the Phase 3 project area.

**Alternative E – Channel Relocation without Beach Nourishment**

Direct and Indirect Impacts. Dredging activities have been shown to increase turbidity within the marine water column. Increased turbidity can create stress to resident flora and fauna by blocking essential light. The sediments of Bogue Inlet have low silt percentages (1.25%) which should allow the project to be constructed without exceeding the State standard outside the immediate construction area. Thus, it is not expected that the channel relocation without beach nourishment project will cause excessive increases in turbidity in the area except in the immediate area of the sand dike during its construction and during the

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

filling of the existing channel with the stockpiled material. Any turbidity increases will be within the state standards and short-lived. Therefore, any direct and indirect effects to the water column are expected to be temporary and minimal.

Cumulative Effects. Turbidity and sedimentation levels are not expected to exceed State standards except in the vicinity of the sand dike during its construction and during the filling of the existing channel with the stockpiled material. Therefore, no cumulative effects to the marine water column are expected from this alternative. Dredging from offshore borrow areas will likely occur with the channel relocation without beach nourishment alternative, and the cumulative effects should be similar to those listed for the no action alternative.

Within a period of 1 to 2 years following the channel relocation, maintenance dredging in the inlet channel would be resumed with the dredged material discharged in the open waters of Bogue Inlet.

Compatibility with Project Objectives. This alternative is compatible with most of the project objectives.

#### Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. Turbidity levels are expected to increase during dredge operations, particularly in the vicinity of the sand dike, but are expected to quickly return to natural levels once the project has been completed. The small percentage of fines (1.25%) and fine to medium sized sand particles (0.27 mm) dredged from the new channel location will have a low suspension time and its effects on the marine water column within the area should be minimal. It is expected that any change in the marine water column will be temporary and minimal.

Cumulative Effects. Nourishment of the beach will be conducted using sediments dredged from the Inlet during the relocation of the channel. Dredged sediment will also be used to create a sand dike on the western edge of Emerald Isle. Deposition of sediment into the open waters of Bogue inlet therefore will be minimized as the dike is constructed. The quality of the marine water column should not experience any cumulative impacts.

Within a period of 1 to 2 years following the channel relocation, maintenance dredging in the inlet channel would be resumed with the dredged material discharged in the open waters of Bogue Inlet.

Compatibility with Project Objectives. This alternative is compatible with the project objectives.

#### 5.19.2 Estuarine

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Alternatives A, B, and C would have the same impacts on the estuarine water column as described below.

Direct and Indirect Impacts. Alternatives A, B, and C would result in regular channel maintenance by the USACE Navigation Branch and the use of an offshore borrow area to complete the Phase 3 beach nourishment project. The potential effects to the estuarine water column from maintenance dredging include an increase in sedimentation during dredging, which stresses the growth and reproductive energies of benthic organisms, and an increase in turbidity, which reduces the penetration of sunlight required by photosynthetic organisms found in the water column. Maintenance dredging involves the discharge of dredged material into the open waters of Bogue Inlet. Thus, water quality within the water column would also be impacted by the discharge of sediment into the inlet, which could lead to a decrease in the quality of estuarine water column resources. The potential for significant negative impacts on the estuarine resources is relatively low due to the low suspension time and travel distances associated with suspended sediment in the inlet. Offshore dredging from a borrow site is not likely to lead to increases in turbidity and sedimentation within the estuarine water column.

Cumulative Effects. Cumulative impacts on the estuarine water column may occur if sedimentation and turbidity levels are high or maintained for long periods of time, making the water column uninhabitable. Considering that the material relocated during maintenance dredging activities contains a low percentage of silt, long-term effects to the estuarine water column are not anticipated. Depending upon the characteristics of the offshore borrow site selected for use in the Phase 3 project, there may be an effect on the estuarine water column during project construction, but these effects are not expected to be cumulative.

Compatibility with Project Objectives. Alternatives A, B, and C do not support the project objectives.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. Dredging activities have been shown to increase turbidity within the estuarine water column. Increased turbidity can create stress to resident flora and fauna by blocking essential light. The sediments of Bogue Inlet have low silt percentages (1.25%) which should allow the project to be constructed without exceeding the State standard except in the vicinity of the sand dike and during the filling of the existing channel. Thus, it is not expected that the channel relocation without beach nourishment project will cause excessive increases in turbidity in the area. Any turbidity increases should be within the state

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

standards and short-lived. Therefore, any direct and indirect effects to the water column are expected to be temporary and minimal.

Cumulative Effects. Turbidity and sedimentation levels are not expected to exceed State standards and therefore, no cumulative effects to the estuarine water column are expected from this alternative. Dredging from offshore borrow areas will likely occur with the channel relocation without beach nourishment alternative, and the cumulative effects should be similar to those listed for the no action alternative.

Compatibility with Project Objectives. This alternative is compatible with the project objectives.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. Turbidity levels are expected to increase during dredge operations, particularly in the vicinity of the sand dike, but are expected to quickly return to natural levels once the project has been completed. The small percentage of fines (1.25%) and fine to medium sized sand particles (0.27 mm) dredged from the new channel location will have a low suspension time and its effects on the estuarine water column within the area should be minimal. It is expected that any change in the estuarine water column would be temporary and minimal.

Cumulative Effects. Nourishment of the beach will be conducted using sediments dredged from the Inlet during the relocation of the channel. Dredged sediment will also be used to create a sand dike on the western edge of Emerald Isle. Deposition of sediment into the open waters of Bogue inlet during the construction of the dike should result in temporary increases in turbidity that would not impact estuarine resources. The quality of the estuarine water column should not experience any cumulative impacts.

Compatibility with Project Objectives. This alternative is compatible with the project objectives as they relate to preservation of the estuarine water column resources.

## 5.20 URBAN QUALITY

Alternatives A, B, and C would have similar impacts on urban quality as described below.

Direct and Indirect Impacts. Alternatives A, B, and C would lead to the continued erosion of western Emerald Isle and threatened homes and roads would be abandoned and demolished or relocated to other areas within the town limits of Emerald Isle. During those times when demolition or relocation activities are underway, the presence of construction equipment would temporarily detract from the aesthetics of the town.

Cumulative Effects. Channel migration to the east and erosion of western Emerald Isle and Bogue Banks is expected to continue. Thus, Alternatives A, B, and C would lead to a reduction in storm protection, and continued loss of land along western Emerald Isle and Bogue Banks. Continued loss of land could lead to the destruction of multiple residences and infrastructure in the Pointe subdivision. Continued erosion along the Town's western boundary could also result in a significant loss of land, property, and roads, which would negatively affect the urban quality of Emerald Isle.

Compatibility with Project Objectives. Alternatives A, B, and C do not support the

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

project objectives.

#### Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. The presence of dredging equipment within the project area would temporarily detract from the aesthetics of the environment, thereby possibly temporarily affecting the visual aesthetics associated with urban quality in Emerald Isle. Relocation of the inlet channel should reverse the erosion conditions currently affecting the area, and result in accretion of additional supratidal land adjacent to the Pointe neighborhood. An increase in home values resulting from the accreted property could result in an increase urban quality on the western end of Emerald Isle.

Cumulative Effects. Relocation of the inlet channel should benefit residential property owners and the Town of Emerald Isle by preventing erosion and thus, the loss of property and infrastructures along the western edge of the Pointe. An increase in property values in the area could also result if the channel relocation without beach nourishment alternative is selected. The Town of Emerald Isle could be required to appropriate additional funds under this alternative to implement the Phase 3 beach nourishment project along the ocean shoreline. If ad valorem taxes are increased to finance the project, the urban quality of the Town may be cumulatively affected. If taxes are not increased, the Town may have to identify other measures to finance the project.

Compatibility with Project Objectives. This alternative is compatible with the project objectives related to erosion control at the Pointe but does not support the project objectives related to beach nourishment and restoration of the Phase 3 shoreline using material from Bogue Inlet.

#### Preferred Alternative F – Channel Relocation with Beach Nourishment

Direct and Indirect Impacts. The presence of dredging equipment within the project area would temporarily detract from the aesthetics of the environment, thereby possibly temporarily affecting the visual aesthetics associated with urban quality in Emerald Isle. Relocation of the inlet channel should reverse the erosion conditions currently affecting the area, and result in accretion of additional supratidal land adjacent to the Pointe neighborhood. An increase in home values resulting from the accreted property could result in an increase urban quality on the western end of Emerald Isle.

Along the Phase 3 shoreline, temporary direct impacts from construction activities could be offset by the additional storm protection benefits resulting from the placement of additional dry beach within the project area. Increased tourism and the revenues generated may indirectly affect the urban quality of the Town.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Cumulative Effects. Implementation of Preferred Alternative F should have an indirect positive impact on urban quality by restoring land lost due to erosion along western Emerald Isle and Bogue Banks. Restoration of eroding land would benefit residential properties along western Emerald Isle by preventing property damage as a result of erosion. Renourishment of the beach along Bogue Banks could lead to an increase in the capacity for recreational beach activity, which could then lead to an increase in tax revenue and tourism commerce.

Compatibility with Project Objectives. This alternative is completely compatible with the project objectives and satisfies the project needs of the Town of Emerald Isle.

## 5.21 SOLID WASTE

### Alternative A – No Action

Direct and Indirect Impacts. The continued eastward migration of the Bogue Inlet shoreline could result in the destruction of homes, roads, and service utilities within the Pointe Subdivision. If threatened structures are not moved out of the Pointe subdivision, they would have to be demolished with the debris deposited in local sanitary landfills. The same would apply to damage to the subdivision roads and some service utilities. Depending on the rate of inlet shoreline erosion, the continued eastward migration of the inlet shoreline could impact between 36 and 51 homes over the next 10 years and up to one-half mile of roads and utilities.

Cumulative Effects. The cumulative effect of demolition and removal of homes and infrastructure debris from the western end of Emerald Isle could reduce the amount of space available at the local landfill over the next ten years. The volume of material that may have to be placed in the landfill is not likely to be considered significant by Carteret County, but ultimately this additional material may have to be accounted for in the County's long range plan for solid waste facilities.

Compatibility with Project Objectives. This alternative is not compatible with the project objectives.

### Alternative B – Without Project – Relocate Homes

Direct and Indirect Impacts. The continued eastward migration of the Bogue Inlet shoreline could result in the destruction of roads and service utilities within the Pointe Subdivision with the debris transported to local landfills. Relocation of the threatened structures would require removal of hardstands such as concrete foundations and driveways with this debris also deposited in local landfills. Depending on the rate of inlet shoreline erosion, the continued eastward migration



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

of the inlet shoreline could impact between 36 and 51 homes over the next 10 years and up to one-half mile of roads and utilities.

Cumulative Effects. The cumulative effect of removal of homes and demolition of infrastructure on the western end of Emerald Isle could reduce the amount of space available at the local landfill over the next ten years. The volume of material that may have to be placed in the landfill is not likely to be considered significant by Carteret County, but ultimately this additional material should be accounted for in the County's long range plan for solid waste facilities.

Compatibility with Project Objectives. This alternative is not compatible with the project objectives.

#### Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. The continued eastward migration of the Bogue Inlet shoreline could result in the destruction of homes, roads, and service utilities within the Pointe Subdivision. If threatened structures are not moved out of the Pointe subdivision, they would have to be demolished with the debris deposited in local sanitary landfills. The same would apply to damage to the subdivision roads and some service utilities. If the home owners and the Town of Emerald Isle elect to continue to install temporary sand bag revetments to provide interim protection to threatened homes, the sand bag revetments must be removed once they have reached the end of their permit period (2 years for homes and 5 years for large structures including roads). In general, the bag material is not salvageable and would also have to be deposited in local landfills. Depending on the rate of inlet shoreline erosion, the continued eastward migration of the inlet shoreline could impact between 23 and 32 homes over the next 10 years and up to one-half mile of roads and utilities.

Cumulative Effects. The cumulative effect of demolition and removal of homes and infrastructure debris from the western end of Emerald Isle could reduce the amount of space available at the local landfill over the next ten years. The volume of material that may have to be placed in the landfill is not likely to be considered significant by Carteret County, but ultimately this additional material should be accounted for in the County's long range plan for solid waste facilities.

Compatibility with Project Objectives. This alternative is not compatible with the project objectives.

Alternatives E and F would have the same impact on solid waste as described below.

Direct and Indirect Impacts. Alternatives E and F would not have any direct or

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

indirect impacts on solid waste resources in the Town of Emerald Isle or Carteret County.

Cumulative Effects. None.

Compatibility with Project Objectives. Alternatives E and F are compatible with the project objectives.

## 5.22 DRINKING WATER

Alternatives A, B, and C would have similar impacts on drinking water as described below.

Direct and Indirect Impacts. Erosion of the inlet shoreline over the next 10 years could affect the potable water distribution system that serves the Pointe subdivision. Once a section of the service line is threatened, the Town of Emerald Isle would have to disconnect that section of the line and reroute it to serve remaining properties. Since the migration of the inlet shoreline would be progressive, the Town would have to make numerous responses to emergencies affecting the water distribution system over the next 10 years. Disconnecting and rerouting the potable water service system would necessitate implementation of a boil water directive for all affected residents for some period of time following resumption of service.

Cumulative Effects. Impacts on drinking water would be continuous and cumulative as long as the inlet shoreline continues to migrate to the east.

Compatibility with Project Objectives. Alternatives A, B, and C are not compatible with the project objectives.

Alternatives E and F would have the same impacts on drinking water as described below.

Direct and Indirect Impacts. No direct or indirect impacts to drinking water supplies or facilities are expected to result from Alternatives E and F.

Cumulative Effects. None.

Compatibility with Project Objectives. Alternatives E and F are consistent with the project objectives.

## 5.23 ECONOMICS

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

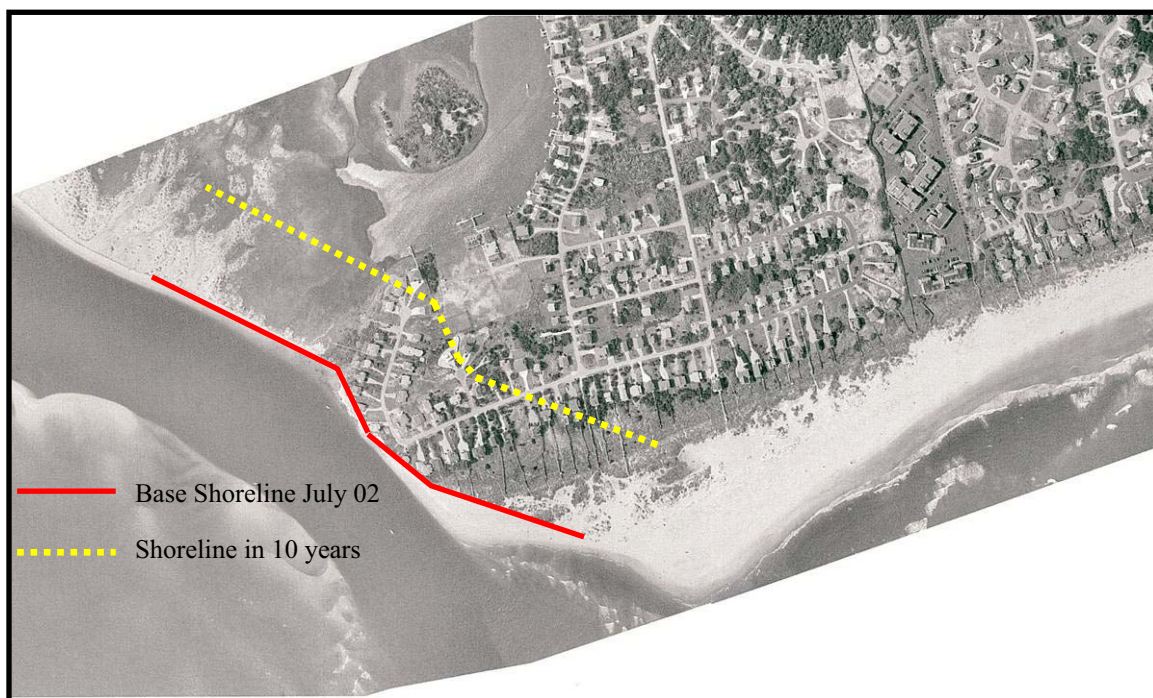
Alternative A – No Action

Direct and Indirect Impacts. The economic impact of Alternative A was evaluated based on the continued eastward migration of the inlet shoreline over the next 10 years. Even though the rate of eastward migration has ranged from 60 feet/year to 90 feet/year since 1984, the rate of eastward migration used in the analysis was 60 feet/year (See Appendix B). The present or base shoreline position and the 10-year shoreline position are shown on Figure 8. The economic impact of the continued eastward migration of the inlet was determined in 2-year increments throughout the 10-year analysis period.

For Alternative A, a structure would be lost to erosion once the inlet shoreline reaches its foundation. When this occurs, the structure would be abandoned and demolished by its owner with the debris transported to a local landfill. The evaluation of the economic impact of Alternative A included damage to real property including cleanup costs once a structure is lost, damage to infrastructure (roads and utilities), construction of temporary access roads to isolated structures, loss of tax revenues for both the Town of Emerald Isle and Carteret County, and the reduction in household spending associated with the lost of homes. Details of the economic impact analysis are provided in Appendix B and summarized in Table 13.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**Figure 8**  
**Without Project Shoreline Projection**  
**Based on Erosion Rate of 60 ft/yr**



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**Table 13**  
**Summary of Damages and Impact on Local Economy**  
**(Alternative A – No Action)**  
**Continued Inlet Shoreline Erosion over the Next 10 Years**

Year	Cumulative Present Worth Damages <sup>(1)</sup>	Cumulative Present Worth Lost Taxes Town & County	Cumulative Present Worth Reduction in Household Spending	Total Present Worth Economic Impact
2	\$1,600,400	\$20,500	\$249,400	\$1,870,300
4	\$4,617,700	\$61,600	\$604,100	\$5,283,400
6	\$6,670,400	\$128,100	\$1,164,900	\$7,963,400
8	\$8,804,500	\$218,400	\$1,884,200	\$10,907,100
10	\$11,492,800	\$337,600	\$2,763,100	\$14,593,500

<sup>(1)</sup> Includes lost structures, damage to infrastructure, and temporary access roads.

The economic impact would include the loss of 36 structures and 1,640 feet of roads (all of Bogue Court and portions of Inlet Drive and Inlet Court) and associated utilities. Emerald Isle still plans to provide beach nourishment along the west end of its shoreline, the cost of nourishing the 23,831 feet of beach using an offshore sand source was added to the economic losses associated with the erosion of the inlet shoreline in order to obtain a full measure of the total economic impact of the without project condition. Table 14 provides the total economic impact of Alternative A including the estimated \$5.8 million for nourishing the west end of Emerald Isle from an offshore sand source.

**Table 14**  
**Total Costs for Without Project – Alternative A – No Action**  
**Including Offshore Nourishment Cost for the West End of Emerald Isle**

Year	Total PW Damages & Economic Impact Plus Offshore Dredging Costs
2	\$ 7,670,300
4	\$ 11,083,400
6	\$ 13,763,400
8	\$ 16,707,100
10	\$ 20,393,500

Cumulative Effects. The loss of the 36 homes over the 10-year analysis period would permanently remove them from the tax base for both the town and county, therefore, the effects on local tax revenues would extend well beyond 10 years.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

The same would apply to the reduction in household spending as the displaced property owners would no longer purchase goods and services in the area. The demolition of the affected structures and debris resulting from the loss of roads and utilities could have a significant impact on the life of local sanitary landfills.

Compatibility with Project Objectives. Alternative A would fail to reduce erosion of the inlet shoreline and as a result would not preserve or maintain the town and county tax base. The continued eastward migration of the inlet shoreline would also destroy a considerable amount of infrastructure including 1,640 feet of roads and associated utilities. Damages to homes and infrastructure would range from \$1.6 million in year 2 to \$11.5 million in year 10 with the total economic impact ranging from \$1.9 million in year 2 to \$14.6 million in year 10. Since the Town of Emerald Isle would have to revert to using an offshore borrow area to complete Phase 3 of its beach nourishment project, the quality of the beach nourishment material the resulting fill could contain higher percentages of shell and shell hash compared to the natural beach. The public access to the inlet shoreline could not be reestablished which would have an impact on the recreational use of the inlet beaches.

#### Alternative B – Without Project – Relocate Homes

Direct and Indirect Impacts. Alternative B involves the relocation of homes once they become threatened with the property owners relocating the structures to some other location within the town limits of Emerald Isle. The inlet shoreline erosion rate used to evaluate this alternative was the same as the Alternative A, i.e., 60 feet/year. Thus, the timeline and the number of structures that would become threatened are the same as the Alternative A. The relocation alternative involves the following:

- a. Purchase of a new lot.
- b. Site work at the new lot that would include the installation of new utilities and the driving of new pile foundations.
- c. Clean-up of the abandoned lot. This would include the removal of any concrete slabs and the removal of the old septic system and other utilities.
- d. Prepare and move the structure to the new lot.
- e. Connecting the structure to the utilities installed on the new lot.

A summary of the cost and damages for the Alternative B for each 2-year increment of the analysis is provided in Table 15. As was the case with the Alternative A, the Home Relocation Alternative would not provide any material for Phase 3 of the Emerald Isle beach nourishment project. Therefore, the town would have to complete Phase 3 using the approved offshore borrow areas at a cost of \$5.8 million. The cost for constructing Phase 3 of the Emerald Isle beach

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

nourishment project using an offshore borrow area is included in the total cost column in Table 15.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**Table 15**  
**Summary of Cost and Damages**  
**Alternative B – Relocate Homes**  
**Including Offshore Nourishment for Phase 3 Town of Emerald Isle**

Year	Cumulative Present Worth Cost to Property Owners	Cumulative Present Worth Damage to Infrastructure	Cumulative Present Worth Lost Tax Revenues Town & County	Present Worth Cost and Damages	Phase 3 Beach Nourishment Cost Using Offshore Borrow Area	Total Economic Cost for Relocation Alternative
2	\$1,482,000	\$267,300	\$6,900	\$1,756,200	\$5,800,000	\$7,556,200
4	\$3,087,900	\$358,700	\$31,800	\$3,478,400	\$5,800,000	\$9,278,400
6	\$4,361,600	\$475,500	\$71,500	\$4,908,600	\$5,800,000	\$10,708,600
8	\$5,060,700	\$575,300	\$124,400	\$ 5,760,400	\$5,800,000	\$11,560,400
10	\$7,127,500	\$667,200	\$191,000	\$ 7,985,700	\$5,800,000	\$13,785,700

Cumulative Effects. The relocation of 36 homes over the 10-year analysis period would preserve the value of the structure but would result in the permanent removal of the value of the abandoned and eroded lot from the tax base of the town and county. This loss in tax revenues would be compounded well beyond the end of the 10-year analysis period.

Compatibility with Project Objectives. The relocation alternative, which also involves the continued eastward migration of the inlet channel and its associated erosion of the inlet shoreline, would not control the inlet shoreline erosion or protect the development at the Pointe. The total economic impact of the Structure Relocation Alternative would range from \$1.75 million in year 2 to \$8.0 million in year 10. A total of 36 structures would be moved from the Pointe area to other sections of Emerald Isle, which would preserve some of the tax base, however, the Town and County would lose the tax value of 41 lots (36 developed and 5 vacant). As with the No Action Alternative, 1,640 feet of roads and utilities would be lost. Public beach access at the Pointe would not be restored to past conditions and the inlet shoreline habitat would continue to deteriorate. This alternative would also cost individual property owners \$7.1 million over a 10 year period. While the economic impact of this alternative is less than the Alternative A, the losses to the local economy and tax base would be substantial. As with the No Action Alternative, beach nourishment material for Phase 3 of the Emerald Isle beach nourishment project would be obtained from offshore borrow areas at a cost of \$5.8 million. Therefore, impacts on recreational opportunities along the Town's ocean shoreline would be the same as Alternative A, i.e., the quality of the beach fill material could be less than ideal.



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Alternative C – Without Project - Sand Bag Revetments

Direct and Indirect Impacts. The economic impact of Alternative C was based on the assumption that sand bag revetments would be constructed to protect buildings and roads once they become threatened. In this regard, the State of North Carolina considers a structure to be threatened once the erosion encroaches within 20 feet of its foundation. In the case of a road, the threatened status begins when erosion reaches the road right-of-way. State rules allow temporary sand bags protecting buildings to remain in place for a period of 2 years after which they must be removed. Sandbag structures constructed to protect roads are allowed to remain in place for 5 years after which they too must be removed. In practice, the State has granted some extensions of the 2-year and 5-year rules, particularly if a long-term protection plan is being formulated. However, for the without project analysis, the assumption was made that no long-term plans are being considered and that the sand bags must be removed at the end of their permit period.

The analysis was carried out on a yearly basis over a period of 10 years using an inlet shoreline erosion rate of 60 feet/year. When erosion threatened a structure, a sand bag revetment would be installed and remain in place for a period of 2 years after which the sand bags would have to be removed resulting in the loss of the structure and exposure of the next row of homes to the erosion threat. When a section of a road is threatened, sand bags would be installed to protect that section of the road. The sand bags protecting the road would remain in place for a period of 5 years after which the sand bag structure would have to be removed resulting in the loss of that section of the road and an increased threat to other sections of the roads which would also be protected by sand bags.

Future damages and economic impacts to Emerald Isle and Carteret County for Alternative C are summarized in Table 16 with the total economic impact, including beach nourishment from an offshore sand source, provided in Table 17.

**Table 16**  
**Summary of Damage and Impact on Local Economy**  
**Alternative C – Sandbag Revetments**

Year	Cumulative Present Worth Damages <sup>(1)</sup>	Cumulative Present Worth Lost Taxes Town & County	Cumulative Present Worth Reduction in Household Spending	Total Present Worth Economic Impact
2	\$1,099,900	\$16,800	\$208,000	\$1,324,700
4	\$2,101,500	\$34,300	\$426,000	\$2,561,800
6	\$3,992,600	\$66,300	\$726,000	\$4,784,900
8	\$6,218,500	\$113,100	\$1,178,100	\$7,509,700
10	\$8,134,900	\$183,500	\$1,859,400	\$10,177,800

<sup>(1)</sup> Includes lost structures, damage to infrastructure, temporary access roads and costs associated with sand bags.

**Table 17**  
**Total Costs for Alternative C – Sandbag Revetments**  
**Including Offshore Nourishment Cost for the West End of Emerald Isle**

Year	Total PW Damages & Economic Impact Plus Offshore Dredging Costs
2	\$7,124,700
4	\$8,361,800
6	\$10,584,900
8	\$13,309,700
10	\$15,977,800

Cumulative Effects. The use of sand bags to provide interim protection to threatened homes and roads would slow but not completely eliminate the erosion of the Pointe subdivision associated with the eastward migration of the inlet shoreline. Over the 10-year analysis period, the value of 23 structures along with their lots would be permanently removed from the town and county tax bases. Thus, there would be a recurring loss to the town and county tax revenues well beyond the 10-year analysis period. The displaced 23 property owners would also impact the local economy for years to come as a result of reduced household spending. While the number of structures that would be demolished under Alternative C is less than Alternative A, there would still be a significant impact on the capacity of existing sanitary landfills.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Compatibility with Project Objectives. The installation of interim sand bags to protect threatened structures and infrastructure on the west end of Emerald Isle would only delay and not eliminate the continued migration of the inlet channel to the east. While such a delay would possible allow more time for the channel to naturally move to a more central position between Bogue Banks and Bear Island, there is no way to predict when or if this would occur. The sand bags would reduce structure loss to 23 and reduce the loss of roads and utilities to around 900 feet; however, the total economic impact would still be rather significant, ranging from \$1.3 million in 2 years to about \$10.2 million in 10 years. Public access to the inlet from the Pointe would not be restored to past conditions and the installation of the interim sand bags would be perhaps more detrimental to the habitat along the inlet shoreline compared to the No Action and Relocation Alternatives. Nourishment of Phase 3 would still have to be accomplished with material obtained from the offshore borrow areas with the same consequences on recreational opportunities as the Alternatives A and B. Again, nourishment of Phase 3 from an offshore borrow area would cost \$5.8 million.

Alternative E – Channel Relocation without Beach Nourishment

Direct and Indirect Impacts. Relocating the Bogue Inlet bar channel to a more central location and using the dredged material to fill in the existing channel should control the erosion of the inlet shoreline for at least 15 years and possibly 35 years depending on the migratory behavior of the relocated channel. The material dredged to construct the new channel could be stockpiled on the upland areas of the existing Emerald Isle sand spit. Due to the relatively short pumping distance from the channel to the stockpile area, the dredging cost for the new channel would be around \$3.0 to \$3.5 million. The mechanical transfer of the stockpiled material to fill the seaward portions of the existing channel could cost between \$4 and \$5 million increasing the total cost of Alternative E to between \$7 and \$8.5 million. In addition, the Town of Emerald Isle would still be faced with the cost of nourishing Phase 3 of its beach nourishment project using an offshore borrow area. This would cost an additional \$5.8 million making the total cost of Alternative E between \$12.8 million and \$14.3 million.

Cumulative Effects. The movement of the inlet channel to a central position will cause the western 7,500 feet of Emerald Isle to erode. However, the amount of shoreline recession should not cause any significant risks to development located along this section of the shoreline as much of the existing dune system would remain and the distance from the structures to the adjusted shoreline should still provide adequate storm protection. The tax base of Emerald Isle would be preserved as would household spending so that these factors would continue to have a positive influence on the local economy for many years.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Compatibility with Project Objectives. The relocation of the inlet channel that would occur under Alternative E should control the erosion of the Pointe shoreline and should preserve the development and infrastructure on the west end of Emerald Isle. As a result, the Town's tax base would be maintained. Material for nourishing the west end of Emerald Isle would have to be obtained from the offshore borrow areas which would add to the total cost of the project. Stockpiling the inlet channel material on the Bogue Banks spit, in addition to causing some environmental harm, would also add to the cost of the project. As a result, the total cost of the project under Alternative E would exceed the budget for the project established by the Town of Emerald Isle.

**Preferred Alternative F – Channel Relocation with Beach Nourishment**

Direct and Indirect Impacts. Relocating the Bogue Inlet bar channel to a more central location and using the dredged material to fill in the existing channel should control the erosion of the inlet shoreline for at least 15 years and possibly 35 years depending on the migratory behavior of the relocated channel. As a result, the town and county tax bases would be preserved. The recovery of the inlet shoreline would allow the reestablishment of public access to the inlet area to past conditions which should enhance recreational opportunities and hence the economy of the town. The inlet material, which is completely compatible with the native beach material, would establish a high quality recreational beach which should also enhance recreational opportunities and have a positive influence on tourist trade.

Cumulative Effects. The relocation of the inlet channel that would occur under Preferred Alternative F should control the erosion of the Pointe shoreline and should preserve the development and infrastructure on the west end of Emerald Isle. As a result, the Town's tax base would be maintained. With the inlet material being used to nourish Phase 3 of the Emerald Isle beach nourishment project, the Town of Emerald Isle would be able to accomplish two major goals at a minimum cost, i.e., protection of the Pointe subdivision and establish a high quality ocean beach for recreation and storm damage protection.

Compatibility with Project Objectives. Preferred Alternative F would accomplish all of the economic objectives of the project by (1) preventing the short term impact of losing 5 to 7 homes over the next few years, (2) maintaining the tax base for both the town and county for at least 15 years and possibly 35 years, (3) allow for the reestablishment of public access to the inlet shoreline to past conditions, and (4) provide high quality beach nourishment material for Phase 3 of the beach nourishment project within the town's budget constraints.

## **5.24 NON-RELEVANT RESOURCE ISSUES**

The following issues have been determined to be non-relevant due to the absence

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

of project affects on the resource.

**5.24.1 Hazardous, Toxic, and Radioactive Waste.** There are no known hazardous, toxic, or radioactive wastes in the project areas that would be affected by the chosen alternative actions. There is a potential for hydrocarbon spills with dredging and construction equipment in the areas, but accident and spill prevention plans delineated in the contract specifications should prevent most spills.

**5.24.2 Noise.** Construction based on the recommended alternatives would temporarily raise the noise level in the areas of the dredge and the discharge point on the beach and at the closure dike site. Construction equipment would be properly maintained to minimize these effects in compliance with local laws.

**5.24.3 Energy Requirements and Energy Conservation.** Energy requirements for the proposed alternatives would be confined to fuel for the dredge, labor transportation, and other construction equipment.

## **5.25 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS**

The following section delineates the applicable Federal and State regulations with which the applicant's preferred alternative must comply prior to issuance of agency approvals for project implementation. Table 18 provides a summary of the applicable regulations and the compliance status of the project.

**5.25.1 National Environmental Policy Act.** A Preliminary Draft Environmental Impact Statement (EIS) for the Bogue Inlet Channel Relocation Project will be submitted to the Federal, State and the Project Delivery Team members in September 2003 for review. The Final EIS is based on the results of comments received from the Draft EIS and coordination efforts during the development of the project. The proposed project will be in full compliance with the National Environmental Policy Act.

**5.25.2 Endangered Species Act.** Coordination with the U.S. Fish and Wildlife Service and NOAA National Marine Fisheries Service (NMFS) includes consultation under Section 7 of the Endangered Species Act of 1973, as amended. The USACE initiated 'informal consultation' with the U.S. Fish and Wildlife Service in December 2002. Based on information submitted under Section 7 consultation, the NMFS determined that the proposed action is not likely to adversely affect any listed species under their purview. The project will be coordinated fully under the Endangered Species Act (ESA).

**5.25.3 Fish and Wildlife Coordination Act.** Consultation with the U.S. Fish and Wildlife Service indicates that a Coordination Act Report may not be required for this project, however direct coordination and consultation with the Service will

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

continue throughout the development of the project. This project will be in full compliance with this Act.

**5.25.4 National Historic Preservation Act.** Archival research, field work and coordination with the North Carolina State Historic Preservation Officer (SHPO), have been conducted in accordance with the National Historic Preservation Act of 1966 (Public Law 89-665), the National Environmental Policy Act of 1969 (Public Law 11-190), Executive Order 11593, the Advisory Council on Historic Preservation Procedures for the protection of historic and cultural properties (36 CFR Part 800) and the updated guidelines described in 36 CFR 64 and 36 CFR 66.

The North Carolina Office of State Archaeology (OSA) protects endangered archaeological sites on private or public lands through enforcement of the North Carolina Archaeological Resources Protection Act (G.S. 70, article 2), the North Carolina Archaeological Records Program (G.S. 70, article 4), and the "Abandoned Shipwreck Law" (G.S. 121, article 3). The project will be in compliance with each of these Federal and State Laws.

Cultural resources investigations of Bogue Inlet include magnetometer and side-scan sonar surveys. Three magnetic anomalies were detected, one in the vicinity of the proposed dike and two in the proposed channel. The two anomalies in the channel area were relatively small and believed to be modern debris such as a crab trap, anchor, or pipe and are not historically significant. The anomaly located in the vicinity of the proposed dike was judged not to be of historical significance. The study concluded that no further investigations are needed. A copy of these investigations was sent to the U.S. Army Corps of Engineers, Wilmington District office on July 25, 2003 for distribution to the State Historic Preservation Officer. Refer to Appendix A Subpart 2, letter from David Brook (NCDCCR) to Samuel Jolly (USACE, Wilmington District) dated October 27, 2003.

**Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement**

**Table 18  
Regulatory Compliance**

<b>Regulation</b>	<b>Lead Agency</b>	<b>Compliance Determination</b>
National Environmental Policy Act of 1969	U.S. Environmental Protection Agency	Status Pending
State Environmental Policy Act of 1971	NC Department of Environmental and Natural Resources	Status Pending
Endangered Species Act of 1973	U.S. Fish and Wildlife Service & National Marine Fishery Service, NC Department of Environmental and Natural Resources	USFWS Status Pending NMFS Compliance
Fish and Wildlife Coordination Act of 1958	U.S. Fish and Wildlife Service U.S. Army Corps of Engineers	SHPO has concurred - no impacts to cultural resources
National Historic Preservation Act of 1966	NC State Historic Preservation Office	SHPO has concurred - no impacts to cultural resources
North Carolina Archaeological Resources Protection Act as amended in 1988	NC Office of State Archaeology	Status Pending
Clean Water Act of 1972 Section 404 Section 401	U.S. Environmental Protection Agency U.S. Corps of Engineers NC Division of Water Quality	Status Pending
Clean Air Act of 1972	U.S. Environmental Protection Agency NC Department of Environmental and Natural Resources	Status Pending
Coastal Zone Management Act of 1972	National Oceanic and Atmospheric Administration Ocean and Coastal Resource Management	Status Pending
Coastal Area Management Act of 1974	NC Department of Environmental and Natural Resources	Status Pending
Marine Mammal Protection Act of 1972	U.S. Fish and Wildlife Service	Status Pending
Federal Water Project Recreation Act as amended in 1976	U.S. Fish and Wildlife Service	Status Pending
Fishery Conservation and Management Act of 1976	National Marine Fisheries Service	Status Pending
Submerged Lands Act of 1953	National Oceanic and Atmospheric Administration NC Department of Coastal Management	Status Pending
Coastal Barrier Resources Act/Coastal Barrier Improvement Act of 1990	U.S. Fish and Wildlife Service	Status Pending
Section 10 Rivers and Harbors Act of 1899	U.S. Army Corps of Engineers	Status Pending
Anadromous Fish Conservation Act as amended in 1965	National Marine Fisheries Service U.S. Fish and Wildlife Service	Status Pending
Migratory Bird Treaty Act as amended 1998 Migratory Bird Conservation Act as amended 1989	U.S. Fish and Wildlife Service	Status Pending
Magnuson-Stevens Fishery Conservation & Mgmt. Act of 1996	National Marine Fisheries Service	Status Pending

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**5.25.5 Clean Water Act.** An application for Section 401 Water Quality Certification will be submitted to the North Carolina Division of Water Quality. All State water quality standards will be met under this project.

A Section 404 evaluation under the Clean Water Act will be applied for and included as Appendix I. The project is expected to be in full compliance with this Act.

**5.25.6 Clean Air Act.** No air quality permits will be required for this project. Exhaust emissions from labor transport and dredge equipment would likely be well under the *de minimus* levels for ozone non-attainment areas (40 CFR 91.853).

In response to a U.S. Environmental Protection Agency requirement, the state of North Carolina recommended that 11 counties and parts of 24 others be designated by the federal government as not meeting air pollution control standards for ozone. Neither Onslow nor Carteret County was listed as non-attainment areas in the State of North Carolina. A final decision based on the recommendations provided by North Carolina will be made by the EPA in April 2004 to determine which areas are listed as non-attainment areas.

Non-attainment areas are the focus of air quality plans for controlling ozone in the State of North Carolina. These plans would include specific proposals for curbing ozone, such as measures to reduce emissions from cars, trucks, industries, and power plants.

This project is being coordinated with the U.S. Environmental Protection Agency (EPA) and will be in compliance with Section 309 of the Act. The Environmental Impact Statement developed for this project will be forwarded to the EPA for their comments.

**5.25.7 Coastal Zone Management Act.** A federal consistency determination in accordance with 15 CFR 930 Subpart C will be included in this report. State consistency review will be performed during the coordination of the Draft EIS document to ensure that the project is consistent with the North Carolina Coastal Area Management Act (CAMA) of 1974, as amended 1981 (Ch. 932, s. 2.1).

**5.25.8 Marine Mammal Protection Act.** Incorporation of the safe guards used to protect threatened and endangered species during dredging and disposal activities would also protect any marine mammals in the area, therefore, this project is in compliance with the Act. A trained and government certified sea turtle and marine mammal observer may be stationed on the dredge during all water-related construction activities. Appropriate actions will be taken to avoid listed sea turtle and marine mammal species effects during project construction. If a marine



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

mammal is identified within the project boundaries, they will be provided protections equal to the ESA species that have had consultations completed, and as a result of this the project sponsor is in compliance with the Act.

**5.25.9 Federal Water Project Recreation Act.** The principles of this Act (Public Law 89-72) as amended will be fulfilled by complying with cost sharing responsibilities as outlined in Section 3 (a)1.

**5.25.10 Fishery Conservation and Management Act.** Coordination with the National Marine Fisheries Service (NMFS) will continue during the review of the Draft EIS. The project will be in full compliance with this Act.

**5.25.11 Submerged Lands Act.** The project will occur on submerged lands of the State of North Carolina. The project will continue to coordinate with the State to ensure full compliance with this Act.

**5.25.12 Coastal Barrier Resources Act and Coastal Barrier Improvement Act.** The western side of Bogue Inlet, including Dudley Island and Bear Island, is listed as an undeveloped coastal barrier as defined by the Coastal Barrier Resources Act. The project is located within an otherwise protected area, however the project is not receiving any Federal monies and is exempt from OPA restrictions. Refer to Section 1.7.9.

**5.25.13 Rivers and Harbors Act.** The proposed activities will involve a temporary restriction of navigable waters of the United States. This temporary restriction will last for no more than 30 days and will occur when the usage of the waterway is at its lowest. The proposed action is subject to the public notice, public hearing, and other evaluations normally conducted for activities subject to the act. The project will be in full compliance with this Act.

**5.25.14 Anadromous Fish Conservation Act.** The project will be coordinated with the National Marine Fisheries Service and will be in compliance with the Act.

**5.25.15 Migratory Bird Treaty Act and Migratory Conservation Act.** Monitoring efforts of the project include identifying the bird species that utilize the project area prior to and post-construction activities. The project is not expected to affect the migratory birds that utilize the area, however a full assessment will be conducted as part of the project efforts. The project will be in full compliance with this Act.

## **5.26 APPLICANT'S PREFERRED ALTERNATIVE**

Preferred Alternative F, channel relocation with beach nourishment, positively addresses all of the project's needs and objectives and should not significantly impact environmental resources in the area. Therefore, Preferred Alternative F is

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

the Applicant's Preferred Alternative. Negative impacts associated with the implementation of Preferred Alternative F would include: (a) temporary increase in turbidity in Bogue Inlet during channel and sand dike construction; (b) temporary increases in turbidity at the discharge point during nourishment of the Phase 3 shoreline; (c) burial of infauna prey resulting from beach nourishment; (d) temporary decrease in tidal flow as the inlet adjust to the new channel (4 to 6 weeks); (e) increase bed load transport into Eastern and Western Channels during the 4 to 6 week channel adjustment period; (f) removal of 47.6 acres of shallow bottom habitat due to channel construction; and (g) cumulative negative impacts due to erosion of the western 7,500 feet of ocean shoreline on Emerald Isle (approximate loss 17.9 acres); (h) potential erosion along the inlet shoreline of Bear Island; (i) temporary displacement of birds. Positive environmental impacts include: (a) immediate and partial restoration of 22.2 acres of subtidal and intertidal habitat from the construction of the sand dike; (b) restoration of the inlet shoreline habitat with the development of a sand spit off the west end of Emerald Isle (sand spit predicted to eventually encompass a total of 127.5 acres of supratidal, intertidal, and subtidal habitat); (c) accretion of the eastern 7,500 feet of ocean shoreline on Bear Island (approximate gain 33.2 acres); (d) relatively rapid biological community recovery of the beach nourishment area due to the highly compatible nature of the inlet material; (e) creation of new shorebird, waterbird, and colonial waterbird habitats with the gradual filling of the existing channel and sand spit development; (g) preventing the disturbance of 141.5 acres of offshore bottom resources associated with an offshore borrow area for the Phase 3 beach fill, and (h) prevention of anthropogenic pollution and solid waste disposal due to the destruction of utilities and other infrastructure in the Pointe subdivision. Positive economic impacts would include the preservation of the town and county tax bases, maintenance of the Emerald Isle economy by preventing a reduction in household spending, increased recreational opportunities resulting from the restoration of public beach access to the inlet shoreline to past conditions, creation of a high quality recreational beach along the 23,831 feet of ocean shoreline included in Phase 3, and accomplish the protection of the Pointe subdivision and restoration of the town's ocean shoreline in one operation.

## **5.27 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES**

**5.27.1 Irreversible.** Preferred Alternative F would remove 47.6 acres of subtidal habitat from the middle of Bogue Inlet and replace it with relative deepwater habitat. New intertidal and subtidal habitat would immediately begin to form with the development of a sand spit off the west end of Emerald Isle. The sand spit would eventually fill approximately 127.5 acres of deepwater habitat associated with the existing channel and replace it with supratidal, intertidal, and subtidal habitat that could essentially offset the impacts of the channel construction. The new channel location will result in erosion of 7,500 feet of the western shoreline of Emerald Isle (approximate loss 17.9 acres) and accretion along

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

the 7,500 feet of the eastern shoreline of Bear Island (approximate gain 33.2 acres). After approximately 4 to 6 years, the physical conditions within Bogue Inlet, in terms of intertidal and subtidal habitat, should resemble the existing composition of these resources. In this regard, the new channel, which would be constructed to a depth of 13.5 feet below NGVD, will probably shoal back to depths comparable to the existing channel in approximately 1 to 2 years. Therefore, no cumulative net gain or loss of these resources is expected.

The material removed from Bogue Inlet to nourish the Phase 3 shoreline (approximately 809,500 cubic yards) should be replaced over time by the influx of abandoned ebb tide delta material lying off the west end of Emerald Isle and the movement of material off the western 7,500 feet of Emerald Isle. The movement of material off the western 7,500 feet of Emerald Isle should result in erosion of this shoreline (approximate loss 17.9 acres); however, some of these erosive impacts should be mitigated by the Phase 3 beach fill that will extend into the shoreline impact area and the continued disposal of navigation maintenance material on the extreme west end of Emerald Isle. Since 1984, the USACE has placed a total of 325,000 cy of channel maintenance material on the western 1,500 feet of Emerald Isle. These disposal operations are expected to continue. The shoreline losses on Emerald Isle could be offset by comparable gains on the eastern 7,500 feet of Bear Island (approximate gain 33.2 acres) resulting in a possible net gain of the beach resources. The use of the inlet material for beach nourishment would eliminate the disturbance of 141.5 acres of offshore bottom that would be required to nourish the Phase 3 shoreline from an offshore borrow area. While the resources within the offshore borrow area would eventually recover, the timeframe for this recovery could be considerably longer than the inlet and the character of the recovered area could probably differ from that of the existing environment.

**5.27.2 Irretrievable.** Under existing conditions, resources on the west end of Emerald Isle are in a constant state of flux due to the continued eastward migration of the inlet channel. The erosion of the inlet shoreline has impacted the normal use of the inlet area that had previously been enjoyed by residents and visitors to Emerald Isle. Continuation of the erosion could result in the irretrievable loss of beach and upland resources on the west end of Emerald Isle. At some time in the future, the Bogue Inlet channel could naturally be repositioned to a more central location between Bogue Banks and Bear Island; however, the resources lost prior to this natural adjustment would not be restored to their present condition resulting in an irretrievable loss. Relocation of the channel should maintain the character of the existing upland resources and allow for the recovery of the beach and dune resources along the inlet shoreline. Some beach and dune resources could be lost to erosion on the west end of Emerald Isle as the shoreline adjust to the new channel position, however, these losses should be offset by comparable

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

gains on the east end of Bear Island and the inclusion of a portion of the impacted Emerald Isle shoreline in the Phase 3 beach nourishment project.

## **5.28 CONFLICTS AND CONTROVERSY**

There are no known conflicts or controversy associated with the applicant's preferred alternative.

## **5.29 UNCERTAIN, UNIQUE, OR UNKNOWN RISKS**

The major uncertainty associated with Preferred Alternative F is the magnitude of the shoreline adjustments along the western 7,500 feet of Emerald Isle and the eastern 7,500 feet of Bear Island. The predicted amount of erosion on the west end of Emerald Isle following relocation of the channel was based on the position the Emerald Isle shoreline occupied in September 1978 when the Bogue Inlet channel was located midway between Bogue Banks and Bear Island. The average amount of recession near the inlet (Figure 9 and Table 19 transects 10 to 13) was predicted to be 350 feet with a maximum possible recession of 400 feet from 2001 shoreline. Shoreline recessions for areas located between 5,000 and 7,500 feet east of the inlet (Figure 9 and Table 19 transects 1 to 5) should average around 10 feet but could erode as much as 80 feet from 2001 shoreline.

Emerald Isle. Historic shoreline positions measured at transects on the west end of Emerald Isle (see Appendix C) were compared to determine the minimum shoreline position (i.e., the most landward shoreline position) for the period March 1943 to September 2001 with the results provided in Table 19. A plot of the minimum and maximum shoreline positions on Emerald Isle along with the predicted shoreline position is shown in Appendix C. Shoreline positions in Table 19 at each transect are given relative to the baseline shown on Figure 3.2 in Appendix B. Also given in Table 19 is the distance from the baseline to the predicted September 1978 shoreline, the predicted amount of shoreline erosion, and the distance from the front of houses to the predicted shoreline and the minimum shoreline.

As indicated in Table 19, the shoreline response in the vicinity of transects 1 and 2 could actually be accretion, however, if the shoreline adjusts to the minimum position, the shoreline could move much closer to the front of the houses. A mitigating factor for the area located between transects 1 and 6 will be the placement of beach fill as part of the Phase 3 beach nourishment project. This beach fill will widen the beach by approximately 35 feet between transects 1 and 2 with the width of the fill decreasing to zero near the west boundary of transect 6. The beach located between transects 8 and 12 could also receive periodic nourishment from the disposal of navigation maintenance material. These two nourishment actions should result in shoreline responses approximating the predicted shoreline rather than the minimum shoreline.

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Table 19  
Minimum and Predicted Shoreline Positions on the West End of Emerald Isle

<b>Transect</b> →	<b>12</b>	<b>11</b>	<b>10</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Min SL Position <sup>(1)</sup>	1327	1235	1170	1202	1149	1174	1156	1118	1179	1194	1177	1123
Predicted SL Position <sup>(2)</sup>	1383	1287	1188	1247	1254	1307	1266	1203	1260	1284	1349	1294
Sep. 2001 SL Position	1737	1663	1497	1451	1386	1340	1331	1294	1294	1284	1275	1275
Predicted SL Change <sup>(3)</sup>	-354	-377	-309	-204	-132	-33	-65	-90	-34	-1	+74	+19
Distance from House to Min SL Position	331	177	98	171	70	95	71	87	80	129	112	58
Distance from House to Predicted SL	387	229	116	216	175	228	181	172	161	219	284	229

<sup>(1)</sup> Minimum position from baseline during period March 1943 to September 2001

<sup>(2)</sup> September 1978 Shoreline Position measured from baseline

<sup>(3)</sup> Predicted shoreline change = (September 2001 shoreline position – September 1978 shoreline position)

**Bear Island.** The shoreline on Bear Island is predicted to accrete in response to the relocation of the Bogue Inlet channel. The predicted amount of accretion on the Bear Island was based on the shoreline returning to approximately the September 1978 position with predicted average accretion ranging from 470 feet for the transects located immediately west of the inlet (transects 25 to 27) to 130 feet for transects 33 to 36 located between 5,000 and 7,500 feet west of the inlet. Historic shoreline positions on Bear Island and the maximum and minimum shoreline positions for the period April 1938 to September 2001 were evaluated with the results plotted and shown in Appendix C and given in Table 20.

Table 20  
Minimum and Maximum Shoreline Positions on the East End of Bear Island  
(April 1938 to September 2001)

<b>Transect</b> →	<b>36</b>	<b>35</b>	<b>34</b>	<b>33</b>	<b>32</b>	<b>31</b>	<b>30</b>	<b>29</b>	<b>28</b>	<b>27</b>	<b>26</b>	<b>25</b>
Min SL Position	603	560	592	653	662	705	667	697	598	300	-118	-390
Max SL Position	976	954	954	981	1006	1035	1035	1107	1185	1268	1303	1429
Max Accretion <sup>(1)</sup>	373	394	362	328	344	330	368	410	587	968	1421	1819
Predicted Accretion <sup>(2)</sup>	105	138	167	173	199	194	222	265	297	369	431	618

<sup>(1)</sup> Difference between Maximum SL Position and Min SL Position

<sup>(2)</sup> Distance from September 1978 SL Position and September 2001 SL Position

Much of the uncertainty associated with the predicted shoreline adjustments on Emerald Isle is associated with horizontal stability of the relocated channel. Based on the behavior of the natural channel, the relocated channel should maintain a

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

position west of the Pointe shoreline for a minimum of 15 years and a maximum of 35 years. If the relocated channel behaves in a manner different from the natural channel and rapidly returns to a position close to the Pointe shoreline, the amount of erosion on the west end of Emerald Isle would be less than predicted. In like manner, the predicted accretion on the east end of Bear Island would also be considerably less than predicted if the channel rapidly migrates back to the east. If the channel moves to the west, erosion on the west end of Emerald Isle would approach the maximum predicted recession while accretion on the east end of Bear Island would be greater than predicted.

### 5.30 ENVIRONMENTAL COMMITMENTS

**5.30.1 Mitigation/Conservation Measures.** The primary areas of concern with implementation of the preferred alternative are: (a) impacts on birds resulting from the possible restoration of pedestrian and vehicular access to the inlet shoreline; (b) unexpected impacts on submerged aquatic vegetation, shellfish beds and salt marsh due to increased sedimentation; and (c) shoreline changes on the ocean facing beaches on the west end of Emerald Isle and the east end of Bear Island. Mitigation/conservation measures that are being considered or evaluated to address these concerns are described below.

**5.30.2 Bird Management Plan.** The Town of Emerald Isle will be responsible for the implementation of a Bird Management Plan. Any new land that could potentially be created either directly or indirectly as a result of the project would be (a) deeded to the Town of Emerald Isle or (b) included in conservation easements. In this regard, the Town of Emerald Isle may pursue ownership of any new land that forms west of the existing property lines on the west end of Emerald Isle. The Town of Emerald Isle may also pursue adopting an ordinance specifically prohibiting any new development within the area deeded to the town or included in the conservation easements. The Town may pursue other ordinances that would include, but not be limited to, restrictions prohibiting or limiting vehicular access to portions of the inlet shoreline, limiting pedestrian access within important foraging and/or nesting habitat, and prohibiting unleashed dogs in the inlet area. Important foraging and/or nesting habitat to which the ordinances would apply would be designated by the North Carolina Wildlife Resources Commission and would be posted and otherwise delineated by ropes and/or flagging. An information kiosk could be erected at the end of Inlet Drive to explain why access is being restricted and could include an explanation of the critical habitat needs of piping plovers and other bird species. Refer to Section 6 for details of this plan.

**5.30.3 Fishery Resource Monitoring/Mitigation Plan.** The submerged aquatic vegetation (SAV) and shellfish beds located within the Permit Area will be surveyed during the summer months following one full year of project operation. Based on the present project schedule, project construction will be completed by the end of

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

February 2005. Therefore, the post-project monitoring would be scheduled for June, July, or August 2006. The survey will include digital aerial photographs and ground truth surveys within the Permit Area and digital aerial photographs of the Project Impact Area. Known shellfish beds and SAV beds located outside the Permit Area but proximate to the Permit Area will also be monitored with ground truth surveys to assess the accuracy of the pre-project predictions. The post-project monitoring results will be compared to pre-project conditions to assess any changes in SAV or shellfish habitat.

Negative changes in SAV or shellfish abundance will be assessed as to their significance with appropriate mitigation measures implemented should the impacts be determined to be significant.

**5.30.4 Shoreline Changes.** The relocation of the main ebb channel through Bogue Inlet to a more central position between Bear Island (Hammocks Beach State Park) and Emerald Isle (west end of Bogue Banks) has been predicted to cause significant changes in the position of the shoreline on both islands. The predicted changes in the shorelines for these two islands were based on a detailed geomorphic analysis of the inlet and adjacent shorelines over the period from 1973 to 2001. The predicted changes are essentially reversals in the shoreline behavior associated with the eastward migration of the main ebb channel from its central location in the mid 1970's to its present location juxtaposed to the west end of Emerald Isle (the Pointe shoreline). In the case of Bear Island, the eastern 7,500 feet of the island is predicted to accrete over 450 feet along sections located immediately west of the inlet to around 130 feet at a point 7,500 feet west of the inlet. On Emerald Isle, the extreme west end of the town's shoreline could erode as much as 400 feet in response to the channel relocation, while the shoreline from between 5,000 and 7,500 feet east of the inlet is expected to erode approximately 10 feet.

Even though the geomorphic analysis and prediction of future shoreline adjustments were based on sound scientific principles, data, and procedures, predictions involving future changes in ocean shorelines are subject to considerable uncertainty. For example, the primary assumption associated with the future shoreline prediction is that the relocated channel will remain centrally located and oriented perpendicular to the adjacent shorelines for some period of time. Eventually, the relocated channel is expected to migrate toward Bogue Banks; however, based on historic channel behavior, the movement of the channel back to its present position could take a minimum of 15 years and a maximum of approximately 35 years. If the relocated channel does not behave in this manner, the prediction of future shoreline changes could be compromised. For example, if the channel moves to the west, this could result in greater amounts of erosion along the Emerald Isle shoreline while the Bear Island shoreline should be positively impacted, i.e., experience even greater amounts of accretion. Should the channel



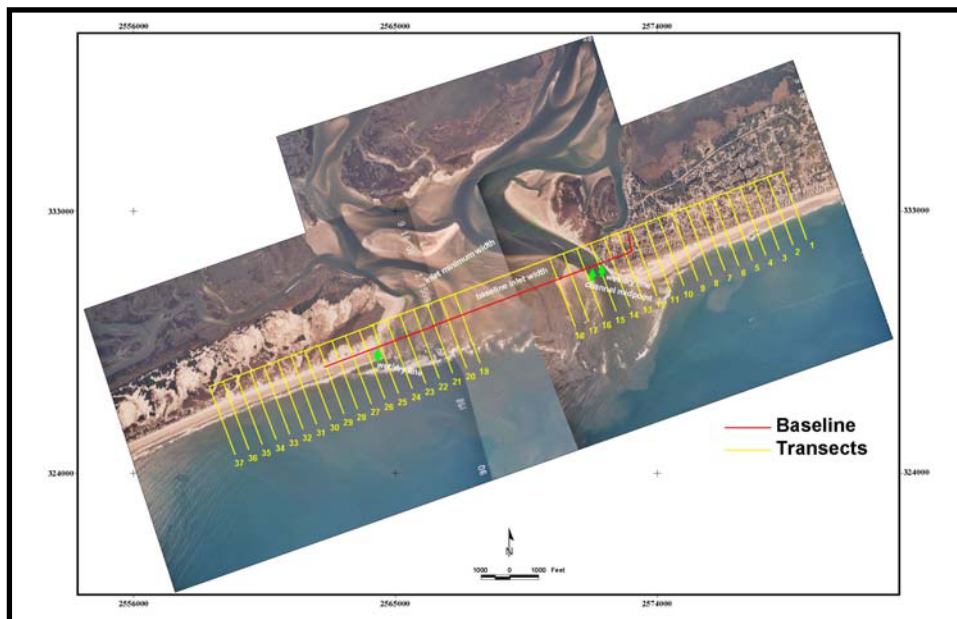
Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

rapidly return to its present position, the Bear Island shoreline would not recover as predicted while predicted erosion along Emerald Isle would be more moderate.

Uncertainties associated with the movement of the channel following its relocation and impacts on the adjacent shorelines are addressed below. The uncertainties will be addressed by establishing erosion thresholds based on past shoreline changes. In the event these erosion thresholds are exceeded, the Town of Emerald Isle could be required to mitigate for the damages.

Shoreline changes on the west end of Emerald Isle and the east end of Bear Island were measured from aerial photographs taken between December 1973 and September 2001 with the results of that analysis presented in Appendix B. Changes in the shorelines were determined for transects spaced at 500-foot intervals along each island as shown on Figure 9. Since some of these transects are presently located within Bogue Inlet, this analysis will focus on transects 1 to 12 on Emerald Isle and transects 25 to 36 on Bear Island which cover 5,500 feet of shoreline on each island.

**Figure 9 Transects used for Shoreline Changes**

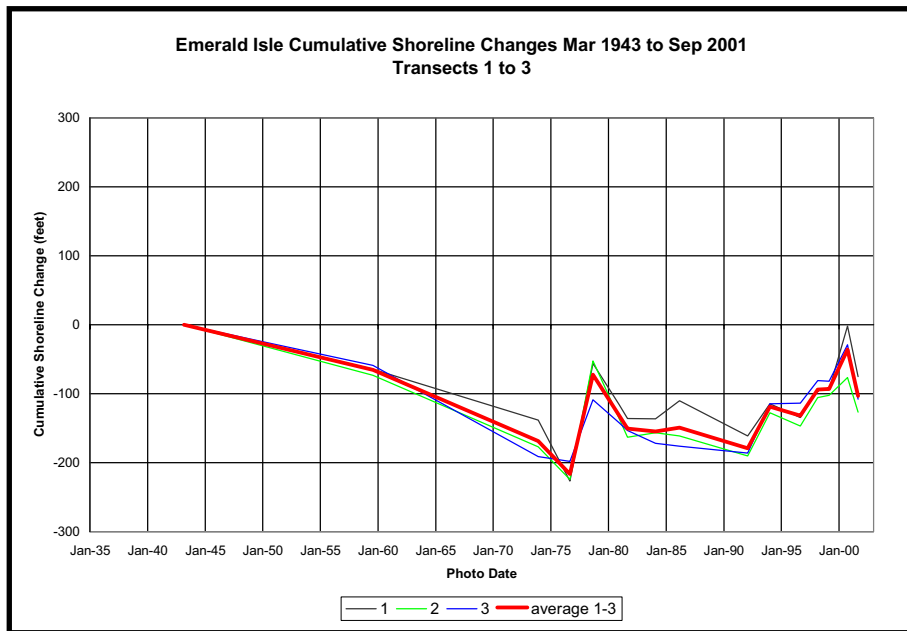


The shoreline changes determined in the geomorphic analysis between December 1973 and September 2001 were combined with shoreline change information available from the State of North Carolina COAST database to extend the historic shoreline change analysis to April 1938 for Bear Island and March 1943 for Emerald Isle. Cumulative shoreline changes on Emerald Isle for the period March 1943 to September 2001 for the 12 transects, in groups of 3 transects, are shown on Figures 10 to 13 while cumulative shoreline changes on Bear Island between

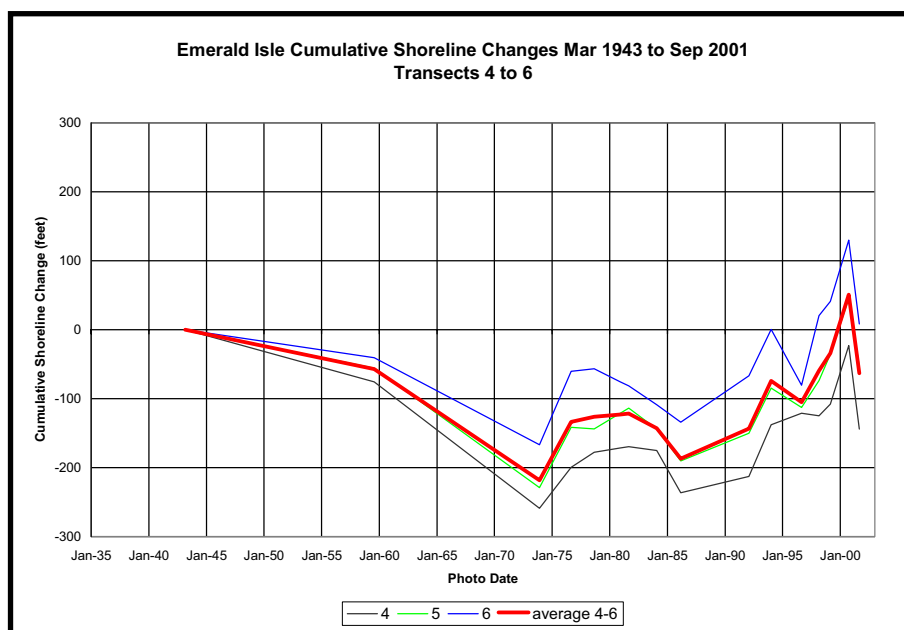
Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

April 1938 and September 2001 are given on Figures 14 to 17. Also shown these figures are the average cumulative shoreline changes for the three transects plotted on each figure.

**Figure 10– Cumulative Shoreline Changes on Emerald Isle – Transects 1 to 3**

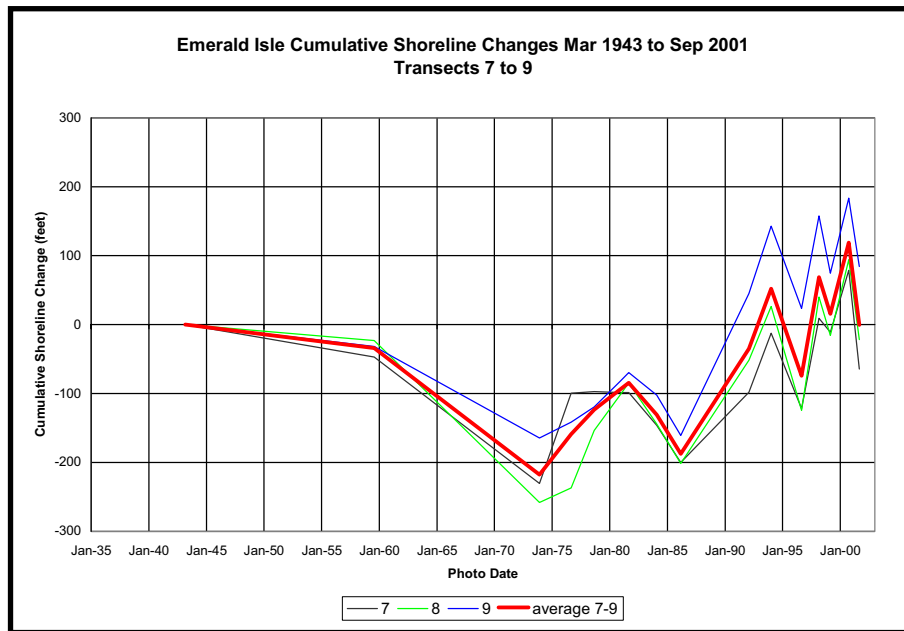


**Figure 11 – Cumulative Shoreline Changes on Emerald Isle – Transects 4 to 6**

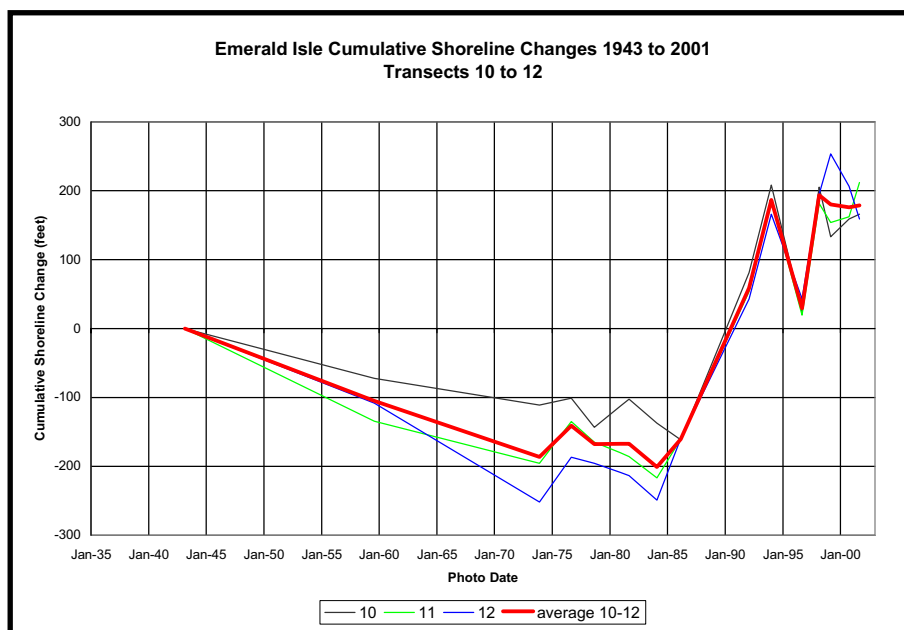


Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**Figure 12 – Cumulative Shoreline Changes on Emerald Isle – Transects 7 to 9**

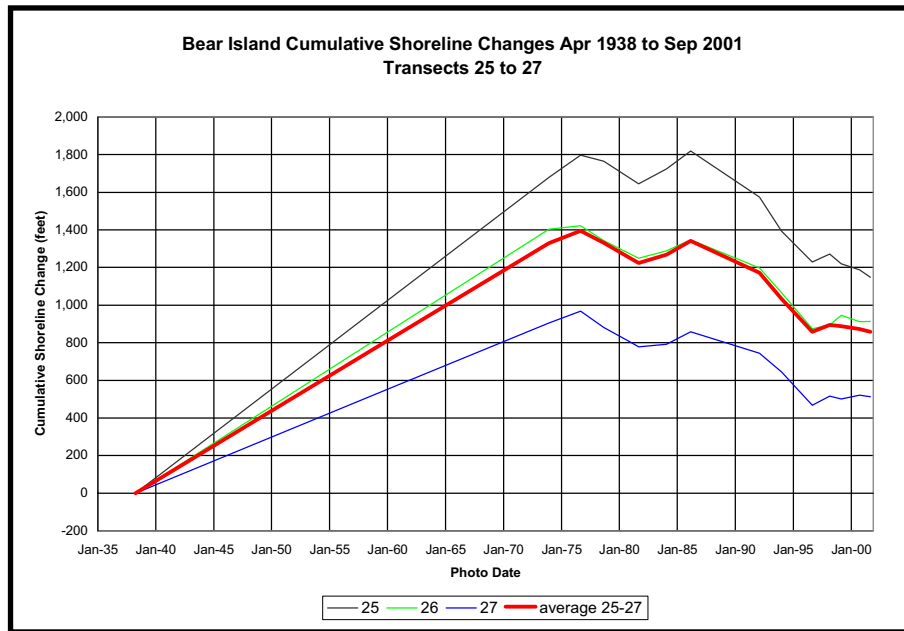


**Figure 13 – Cumulative Shoreline Changes on Emerald Isle – Transects 10 to 12**

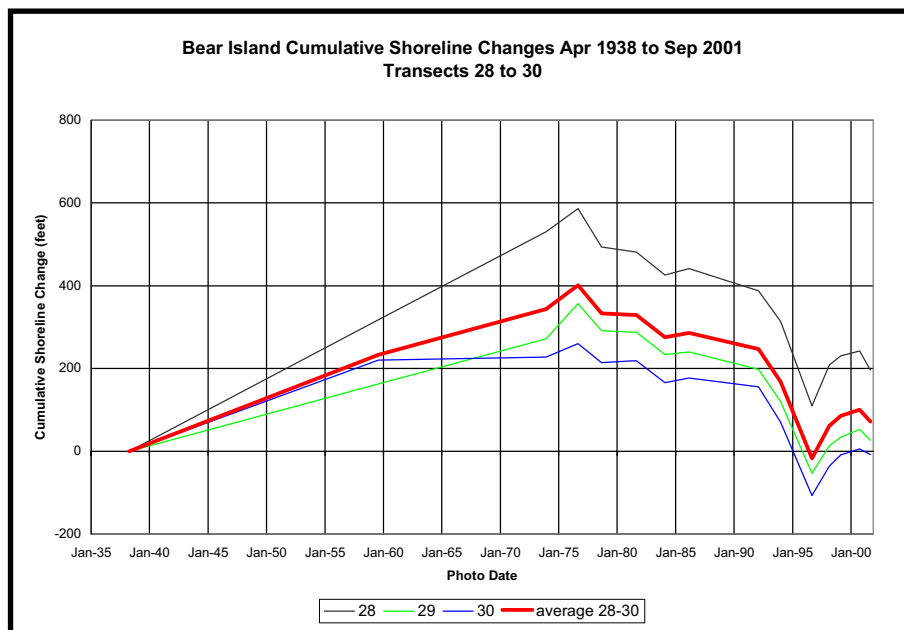


Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**Figure 14 – Cumulative Shoreline Changes on Bear Island – Transects 25 to 27**

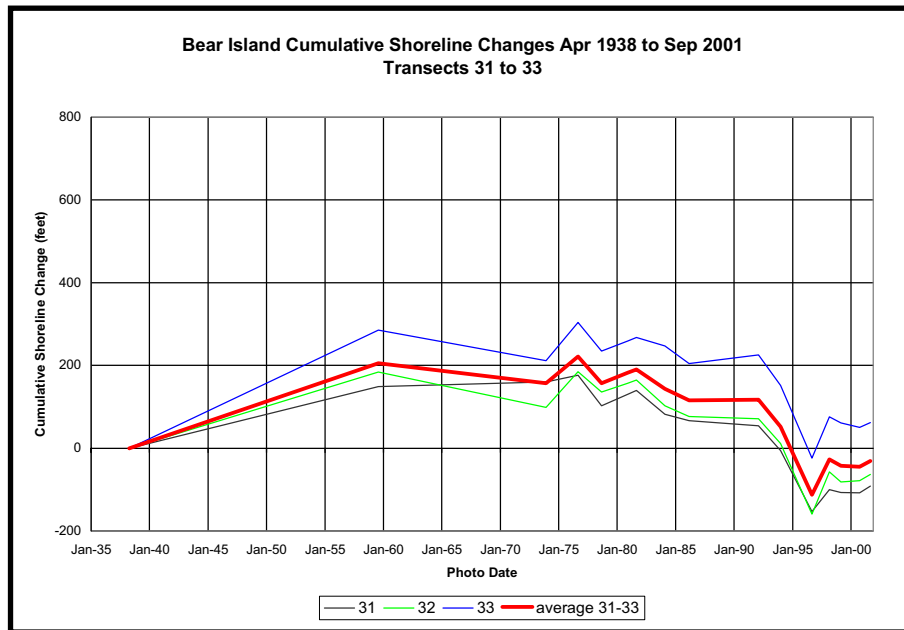


**Figure 15 – Cumulative Shoreline Changes on Bear Island – Transects 28 to 30**

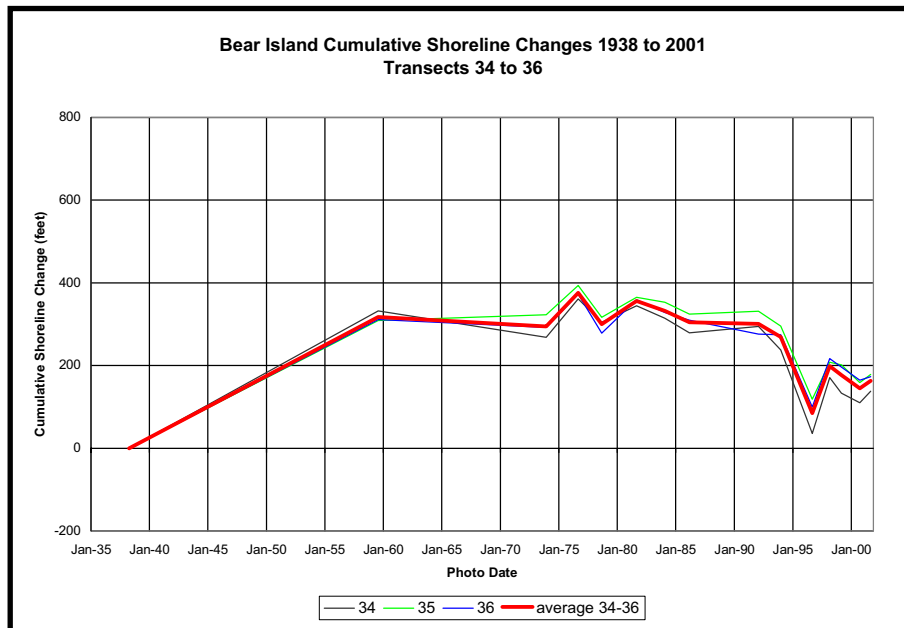


Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

**Figure 16 – Cumulative Shoreline Changes on Bear Island – Transects 31 to 33**



**Figure 17 – Cumulative Shoreline Changes on Bear Island – Transects 34 to 36**



Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

The cumulative shoreline changes for Emerald Isle, given on Figures 10 to 13, show general high rates of erosion for all transects from March 1943 to around September 1976. This period of general erosion was followed by a short period of moderate erosion to relative stability between September 1976 and March 1986 (shoreline change rates varied from +1.4 ft/yr to -5.4 ft/yr). From March 1986 to September 2001, all transects accreted with the amount of accretion decreasing with increased distance from Bogue Inlet. With the exception of the September 1976 to March 1986 period, the behavior of the shoreline on Bear Island has been a mirror image of the shoreline changes on Emerald Isle with general accretion between April 1938 to September 1976 and erosion from March 1986 to September 2001. For the latter period, the highest rates of erosion occurred near Bogue Inlet with the rate of erosion decreasing with increased distance from Bogue Inlet. While Emerald Isle experienced both accretion and moderate erosion between September 1976 and March 1986, transects 25 to 33 on Bear Island eroded at rates ranging from -7.0 to -11.7 ft/yr. The average rates of change in the shoreline position for the various time periods discussed above and for the period from September 1976 to September 2001 are summarized in Table 21. The shoreline change rates were determined from linear regression trends through the average shoreline positions for each of the 3-transect groups over the various time periods.

Table 21  
Average Shoreline Change Rates for Various Time Periods  
(Rates are the average for 3 adjacent transects)

<b>Emerald Isle</b>	<b>Mar 43 to Sep 76</b>	<b>Sep 76 to Mar 86</b>	<b>Mar 86 to Sep 01</b>	<b>Sep 76 to Sep 01</b>
Transect Group	Rate ft/yr	Rate ft/yr	Rate ft/yr	Rate ft/yr
1 to 3	-6.2	+1.4	+6.1	3.0
4 to 6	-5.4	-5.4	+11.7	5.1
7 to 9	-6.1	-2.7	+13.9	9.1
10 to 12	-4.9	-3.0	+20.2	17.9
<b>Bear Island</b>	<b>Apr 38 to Sep 76</b>	<b>Sep 76 to Mar 86</b>	<b>Mar 86 to Sep 01</b>	<b>Sep 76 to Sep 01</b>
Transect Group	Rate ft/yr	Rate ft/yr	Rate ft/yr	Rate ft/yr
25 to 27	+36.7	-7.0	-33.2	-21.2
28 to 30	+10.0	-11.7	-15.7	-12.8
31 to 33	+4.9	-9.0	-12.7	-10.5
34 to 36	+8.8	-4.1	-11.8	-8.2

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

Historic shoreline positions on the west end of Emerald Isle for the period March 1943 to September 2001 are shown in Appendix C. The predicted shoreline following the relocation of the channel is represented by the September 1978 shoreline; however, as shown, historic shorelines on Emerald Isle have been located farther inland than the September 1978 shoreline. The maximum and minimum shoreline positions measured at each transect on the west end of Emerald Isle during the 1943 to 2001 period have also been plotted (Appendix C). Also shown is the September 1978 shoreline, the shoreline position expected to following the relocation of the Bogue Inlet bar channel. Should the shoreline erode to or past the September 1978 shoreline or otherwise create a serious threat to upland development, the Town of Emerald Isle should consider nourishing the affected beach.

Bear Island has experienced a considerable amount of erosion since 1976 with the rate of erosion increasing between 1986 and 2001. The historic shoreline positions on the east end of Bear Island for the 1938 to 2001 period are shown in Appendix C. The maximum and minimum shoreline positions along with the predicted September 1978 shoreline (Appendix C). While the predicted response of Bear Island to the relocation of the Bogue Inlet channel is accretion, should the island actually experience an increase in the rate of erosion over the historic rate, the Town of Emerald Isle would be responsible for mitigating this erosion. In order to account for the most recent change in the erosion rate on Bear Island, the average erosion rate for each of the 3-transect groups for the period 1976 to 2001 was used as the base erosion rate with the upper limit of acceptable erosion for each of the 3-transect groups determined from the variability of shoreline changes that occurred between 1986 and 2001. For the 1986 to 2001 shoreline change rate, the upper 95% confidence limit was determined based on the standard deviation of the shoreline change rates within each of the 3-transect groups. The base shoreline erosion rates for the 1976 to 2001 time period were increased by one-half of the 95% confidence limit to determine the erosion threshold rate for each of the 3-transect groups. This procedure is summarized in Table 22.

Table 22  
Erosion Threshold Shoreline Change Rates for Bear Island

Transect Group	Base SL Change Rate 1976 to 2001 (ft/yr)	Average SL Change Rate 1986 to 2001 (ft/yr)	95% Confidence Limit for 1986 to 2001 Rate (ft/yr)	Erosion Threshold = (1976 to 2001 rate) + (- one-half of the 95% confidence limit for 1986 to 2001)
25 to 27	-22.0	-33.2	11.0	-27.5
28 to 30	-13.8	-15.7	2.6	-15.0

Bogue Inlet Channel Erosion Response Project  
Final Environmental Impact Statement

31 to 33	-11.4	-12.7	0.8	-11.8
34 to 36	-9.0	-11.8	1.6	-9.8

By using the 1976 to 2001 rates as the base rate and adjusting the base rate by the variability in the shoreline change rates between 1986 and 2001, the erosion threshold shoreline change rates fall between the long-term 1976 to 2001 rates and the short term 1986 to 2001 rates. The rate of shoreline change on Bear Island will be determined from a combination of aerial photographic comparisons and conventional beach profile survey techniques with both aerial photographs and conventional surveys being made twice a year. In order to take into account possible short term fluctuations in the shoreline due to storms, the erosion threshold rates would have to be exceeded in two adjacent 3-transect groups for a period of one year. This one-year confirmation period is based on the amount of time shorelines normally take to recover from the impacts of severe coastal storms. Note that this time period would be extended if the area is impacted by a sequence of two or more significant storms within the confirmation period. For example, assume that transect groups 31 to 33 and 34 to 36 have erosion rates greater than the threshold amounts during the first year following channel relocation. If the erosion rates still exceed the threshold rates at the end of the second year following channel relocation, mitigation could be required. If however a storm occurs 6 months after the threshold violation and the storm causes significant shoreline recession not only on Bear Island but other nearby areas, the confirmation period would be extended 12 months from the date of that storm. Monitoring of the shoreline changes on Bear Island would continue for a period of 5 years following the channel relocation project.

The method of mitigating the erosion on Bear Island would be determined based on consultation with the NC Division of Parks and Recreation.

Table 23 provides a summary of the impacts and changes to the associated resource as a result of the implementation of each alternative.

A list of preparers, with their qualifications, experience, and corresponding roles in the preparation of this Environmental Impact Statement (EIS), is provided in Table 24.



**Table 23**  
**Summary of Direct, Indirect, and Cumulative Impacts**  
**Bogue Inlet, North Carolina**

<b>Environmental Factors</b> <b>Bogue Inlet, North Carolina</b>	<b>Definition of Impact Timeframes</b>	<b>Alternative A – No Action</b>	<b>Alternative B – Relocate Homes</b>	<b>Alternative C – Sandbag Revetments</b>	<b>Alternative E – Channel Relocation without Beach Nourishment</b>	<b>Alternative F – Channel Relocation with Beach Nourishment</b>
<b>5.3 VEGETATION</b> 5.3.1 Maritime Hammock  5.3.2 Beach and Dune Communities	No associated timeframe Direct = days Indirect = 0 to 2 years (2 yrs = beach stabilization time) Cumulative = after 2 yrs.	Insignificant A loss of 600 feet of ocean shoreline and the Bogue Banks sand spit is likely. Continued erosion on the east end of Bear Island. Nourishment of Phase 3 with offshore sand source. Short-term negative direct impacts during nourishment from burial of beach organisms.	Insignificant Same as Alternative A	Insignificant Direct mortality from sand bag placement and possible loss of 240 feet of ocean shoreline and loss of Bogue Banks sand spit. Continued erosion on the east end of Bear Island. Nourishment of Phase 3 with offshore sand source. Short-term negative direct impacts during nourishment from burial of beach organisms.	Insignificant Direct negative impacts to communities on Bogue Banks sand spit from dike construction and stockpiling of material. Positive cumulative impacts from the recovery of the inlet shoreline and dune communities. Negative long-term impact from the expected erosion of 7,500 feet on west end of Emerald Isle. Positive long-term impacts from accretion of 7,500 feet on east end of Bear Island is anticipated. Nourishment of Phase 3 with offshore sand source will include the eastern portion of the affected shoreline on Emerald Isle. Phase 3 delayed until 2007-2008 for funding. Short-term negative direct impacts during nourishment from burial of beach organisms.	Insignificant Direct negative impacts on the Bogue Banks sand spit from dike construction and temporary stockpiling of material. Positive cumulative impacts from the recovery of the inlet shoreline and dune communities. Negative long-term impact from the expected erosion of 7,500 feet on the west end of Emerald Isle. Positive long-term impact from accretion of 7,500 feet on east end of Bear Island is anticipated. Nourishment of Phase 3 with inlet material will include the eastern portion of the affected shoreline on Emerald Isle. Short-term negative direct impacts during nourishment from burial of beach organisms.
<b>5.3.3 Salt Marsh Communities</b>	Direct = 0 to 3 days (3 days = est. max settling time of med. grain sediments) Cumulative = 2 to 4 years	Negative direct long-term if breaching of sand spit destroys the substantial high quality salt marsh community on the sound side of the sand spit. Negative cumulative impacts if hydraulics change and high salt marsh becomes inundated or transitions to low salt marsh resource.	Same as Alternative A.	Same as Alternative A.	Positive indirect and cumulative impacts from the restoration of the inlet shoreline and preventions of the possible breach of the existing sand spit. Allows for the preservation of the character of the sand spit and prevents the possible loss of high salt marsh located on the sound side of the sand spit.	Same as Alternative E.
<b>High Salt Marsh</b>						

<p><b>Low Salt Marsh</b></p>	<p>Direct = 0 to 3 days (3 days = est. max. settling time of med. grain sediments) Indirect = 6 mos. to 2 and up to 4 years 6 mos. To 2 yrs. = beach stabilization time; 4 years = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 years</p>	<p>Negative direct impacts to low marsh lining the old Coast Guard Channel if breaching of the Bogue Banks sand spit occurs. Sand spit would evolve to an overwash terrace. Negative cumulative impacts if inlet hydraulics change to include flow through old Coast Guard Channel. Positive long-term impact if high marsh is converted to low marsh along old Coast Guard Channel and behind sand spit.</p>	<p>Same as Alternative A.</p>	<p>Same as Alternative A.</p>	<p>Positive indirect and cumulative impacts. Restoration of the inlet shoreline and prevention of the possible breach of the Bogue Banks sand spit. Allows for the preservation of the character of the sand spit and prevents the possible loss of low marsh located on the sound side of the sand spit.</p>	<p>Same as Alternative E.</p>
<p>5.3.4 Submerged Aquatic Vegetation (SAV)</p>	<p>Direct = 0 to 3 days (3 days = est. max. settling time of med. grain sediments) Indirect = 6 mos. To 2 and up to 4 years (6 mos. To 2 yrs = beach stabilization time; 4 yrs = time for sand spit to merge with sand dike under Alternative F0) Cumulative = 2 to 4 years</p>	<p>Negative direct, indirect, and cumulative impacts if breaching of the Bogue Banks sand spit changes water flux, salinity, or turbidity in Bogue Sound where SAV have historically been found.</p>	<p>Same as Alternative A.</p>	<p>Same as Alternative A.</p>	<p>Negative direct impacts from temporary suspension of sediments and possible increase in turbidity due to project construction.</p>	<p>Same as Alternative E.</p>
<p><b>5.4 THREATENED AND ENDANGERED SPECIES</b></p>						
<p>5.4.1 Sea Turtles</p>	<p>Direct = days Indirect = 0 to 2 yrs. (2 yrs = beach stabilization time) Cumulative = after 2 yrs.</p>	<p>Minor direct and indirect negative impacts for the probable formation of vertical erosion scarps on the Emerald Isle inlet shoreline. Negative direct and indirect impacts along the 7,500 feet of ocean shoreline on the east end of Bear Island due to erosion scarps. Positive long-term impacts from nourishment of the Phase 3 shoreline using an offshore sand source are possible.</p>	<p>Same as Alternative A.</p>	<p>Minor negative direct and indirect impacts are possible along inlet shoreline protected by sandbags. Positive long-term impacts from nourishment of the Phase 3 shoreline using an offshore sand source should occur.</p>	<p>Negative long-term indirect impacts from erosion of western 7,500 feet of Emerald Isle ocean shoreline. Positive long-term impacts from nourishment of the Phase 3 shoreline using an offshore sand source should occur. Phase 3 would extend into the affected shoreline on the west end of Emerald Isle. Positive long-term indirect impacts are possible if accretion of the eastern 7,500 feet of Bear Island occurs.</p>	<p>Negative long-term indirect impacts from erosion of western 7,500 feet of Emerald Isle ocean shoreline. Positive long-term impacts should occur from nourishment of the Phase 3 shoreline using material from Bogue Inlet. Phase 3 would extend into the affected shoreline on the west end of Emerald Isle. Positive long-term indirect impacts if accretion of the eastern 7,500 feet of Bear Island occurs.</p>
<p>5.4.2 Mammals Humpback and Right Whales</p>	<p>No associated timeframe</p>	<p>Insignificant</p>	<p>Insignificant</p>	<p>Insignificant</p>	<p>Insignificant</p>	<p>Insignificant</p>

<b>West Indian Manatee</b> 5.4.3 <b>Birds</b>	No associated timeframe	Insignificant	Insignificant	Insignificant	Insignificant
<b>Piping Plover</b>	<p>Direct = days</p> <p>Indirect = 0 to 4 yrs.</p> <p>(4 yrs = time for sand spit to merge with sand dike under Alternative F)</p> <p>Cumulative = after 4 yrs.</p>	<p>The continued westerly migration of Island 2 and erosion of the east end of Bear Island could result in the loss of habitat.</p> <p>Breaching of the Bogue Banks sand spit could have both positive and negative indirect impacts as the spit would evolve from and upland area to an overwash terrace.</p> <p>Dynamic nature of Bogue Inlet area would continue to provide suitable habitat for piping plover with no significant cumulative impacts.</p>	Same as Alternative A.	Same as Alternative A.	<p>Island 2 will likely continue to migrate to the west and could disappear. Direct negative impacts for the presence of construction and loss of infauna prey base. Long-term positive impacts could occur from the gain of habitat on the west end of Emerald Isle (development of sand spit) and accretion of the ocean shoreline on the east end of Bear Island.</p> <p>Negative long-term impacts could occur due to erosion of ocean shoreline on the west end of Bogue Banks. Long-term negative impacts are possible due increased pedestrian and vehicular access to the inlet shoreline.</p>
<b>Critical Habitat for Wintering Piping Plover</b>	<p>Direct = days to months (during dredging operations)</p> <p>Indirect = 0 to 4 years</p> <p>(4 yrs = time for sand spit to merge with sand dike under Alternative F)</p> <p>Cumulative = after 4 yrs.</p>	<p>Cumulative impacts due to the loss of habitat on the east end of Bear Island. Breaching of the Bogue Banks sand spit could have both positive and negative impacts as the area would evolve from an upland area with fringe marsh to an overwash terrace.</p> <p>Dynamic nature of Bogue Inlet area would continue to provide suitable habitat for piping plover with no significant cumulative impacts</p>	Same as Alternative A.	Same as Alternative A.	<p>Positive cumulative gain habitat from accretion along Bear Island shoreline. Negative cumulative impact due to loss of habitat from erosion on the west end of Emerald Isle shoreline.</p> <p>Positive long-term indirect impacts from the development of sand spit off the west end of Emerald Isle, which should fill the existing channel and create shallow water habitat and upland nesting and loafing areas. Long-term negative impacts due to increased pedestrian and vehicular access to the inlet</p>

						inlet shoreline. If properly managed, the overall cumulative impacts should be positive.	
<b>Roseate Tern</b>	Direct = days to months (during dredging operations) Indirect = 0 to 4 years (4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = after 4 yrs.	Impacts on roseate tern habitat would be similar to the impacts on piping plover habitat.	Impacts on roseate tern habitat would be similar to the impacts on piping plover habitat.	Impacts on roseate tern habitat would be similar to the impacts on piping plover habitat.	Impacts on roseate tern habitat would be similar to the impacts on piping plover habitat.	Impacts on roseate tern habitat would be similar to the impacts on piping plover habitat.	
<b>5.4.4 Seabeach Amaranth</b>	Direct = days to months (during beach nourishment operation) Indirect = 0 to 4 yrs. (4 yrs. = time for sand spit to merge with sand dike under Alternative F) Cumulative - after 4 yrs.	Negative cumulative impacts due to erosion of 600 feet of ocean shoreline on west end of Emerald Isle associated with eastward migration of inlet channel, and erosion of the eastern 7,500 feet of Bear Island, which are likely to continue. Positive cumulative impacts could occur from nourishment of Phase 3 shoreline using offshore borrow material and possible inclusion of area in Federal storm damage reduction project.	Same as Alternative A.	Same as Alternative A.	Negative cumulative impacts for the loss of potential habitat along the beach and dune system on the western 7,500 feet of Emerald Isle. Positive cumulative impacts from gain in beach dune system habitat on the eastern 7,500 feet of Bear Island and eventual restoration of potential habitat along 23,831 feet of ocean shoreline associated with Phase 3 nourishment with offshore borrow area and possible inclusion of area in Federal storm damage reduction project. . Phase 3 would extend into the affected shoreline on the west end of Emerald Isle. Positive cumulative impacts from the continued development of the sand spit off the west end of Emerald Isle.	Negative cumulative impacts for the loss of potential habitat along the beach and dune system on the western 7,500 feet of Emerald Isle. Positive cumulative impacts from gain in beach dune system habitat on the eastern 7,500 feet of Bear Island and eventual restoration of potential habitat along 23,831 feet of ocean shoreline associated with Phase 3 nourishment with offshore borrow area and possible inclusion of area in Federal storm damage reduction project. . Phase 3 would extend into the affected shoreline on the west end of Emerald Isle. Positive cumulative impacts from the continued development of the sand spit off the west end of Emerald Isle.	
<b>5.5 MARINE RESOURCES</b>							
<b>5.5.1 Inlet Resources</b>	Direct = days to months (during dredging operation) Indirect = 1 to 2 years. (1 to 2 yrs = Infaunal recovery time for medium grain sediments) Cumulative = after 2 years.	Short-term negative impacts from USACE maintenance dredging.	Same as Alternative A.	Negative impacts due to sandbag revetments.	Short-term negative impacts associated with dredging of new channel, burial due to dike construction and stockpiling of material on the Emerald Isle sand spit and burial with closure of existing channel. Short-	Short-term negative impacts associated with dredging of new channel and burial due to dike construction. Short-term negative impacts with the resumption of USACE maintenance dredging in 1 to 2 years after channel	
<b>Benthic Infaunal Community</b>							

						term negative impacts with the resumption of USACE maintenance dredging in 1 to 2 years after channel relocation.	relocation.
Shellfish	Direct = 0 to 3 days (3 days = est. max. settling time of med. grain sed.) Indirect = 6 mos. To 2 and up to 4 years (6 mos. To 2 yrs. = beach stabilization time; 4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 yrs.	Negative direct and cumulative impacts due to possible breach of the Bogue Banks sand spit which would reroute flow to old Coast Guard Channel possibly impacting water quality and sediment influx.	Same as Alternative A.	Same as Alternative A.		Negative short-term impacts due to increased turbidity during construction. Sediment redistribution to sound and ebb tide delta for period of 4 to 6 weeks after construction as new channel develops equilibrium cross-sectional area.	Same as Alternative E.
	Direct = 0 to 3 days (3 days = est. max. settling time of med. grain sed.) Indirect = 6 mos. To 2 and up to 4 years (6 mos. To 2 yrs. = beach stabilization time; 4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 yrs	Insignificant	Insignificant	Insignificant		Negative short-term direct impacts due to construction noise. Negative short-term indirect impacts from increases in turbidity during construction and the temporary loss of infaunal prey from new channel area, sand dike construction, stockpiling of channel material, and filling of existing channel.	Negative short-term direct impacts due to construction noise. Negative short-term indirect impacts from increases in turbidity during construction and the temporary loss of infaunal prey from new channel area and sand dike construction.
Marine Mammals - Dolphins	Direct = days to months (during construction) Indirect = 0 to 4 years (4 years = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 yrs.	Insignificant	Insignificant	Insignificant		Negative direct impacts form construction noise.	Negative direct impacts form construction noise.
Intertidal Flats and Shoals	Direct = days to months (during construction) Indirect = 0 to 4 years (4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = after 4 yrs.	Continue erosion of the inlet shoreline will convert some upland area of the Pointe to intertidal shoals and sand flats. Material eroded from the upland area will be redistributed to the sound and outer portions of the ebb tide delta.	Insignificant	Insignificant		Direct negative impacts for the loss of 47.6 acres of subtidal shoals due to new channel construction and short-term negative impacts on 22.8 acres on the Emerald Isle sand spit from the stockpile of dredged material. Long-term positive impacts with restoration of 127.5 acres from dike construction, filling of existing channel, and development of sand spit off the west end of	Direct negative impacts for the loss of 47.6 acres of subtidal shoals due to new channel construction. Partial restoration of 22 acres from dike construction. Long-term positive impacts with the development of sand spit off the west end of Emerald Isle which will eventually fill 127.5 acres of the existing channel.

5.5.2 Beach Resources						Emerald Isle.	
	<p>Direct = days Indirect = 0 to 2 years (2 yrs = beach stabilization time) Cumulative = after 2 yrs</p>	<p>Direct negative impacts could result from the possible loss of beach and dune habitat along 600 feet on the western end of Emerald Isle due to the eastward migration of the inlet channel and erosion of the eastern 7,500 feet of Bear Island. Restoration of 23,831 feet of ocean shoreline on Emerald Isle with nourishment of Phase 3 with offshore material.</p>	Same as Alternative A.	<p>Direct negative impacts from the loss of beach and dune habitat along 240 feet on the western end of Emerald Isle due to the eastward migration of the inlet channel and erosion of the eastern 7,500 feet of Bear Island. Positive cumulative impacts from the restoration of 23,831 feet of ocean shoreline on Emerald Isle with nourishment of Phase 3 with offshore material.</p>	<p>Temporary negative impacts to the Bogue Banks sand spit from dike construction and the Long-term direct positive impacts should occur with filling of existing channel and long-term indirect impacts from the rapid development of sand spit off the west end of Emerald Isle.</p> <p>Negative indirect impacts from erosion of 7,500 feet of ocean shoreline on west end of Emerald Isle. Positive indirect impacts from accretion of 7,500 feet of ocean shoreline on east end of Bear Island. Positive cumulative impacts should occur from the restoration of 23,831 feet of ocean shoreline on Emerald Isle with nourishment of Phase 3 with offshore material. Phase 3 would extend into the affected shoreline on the west end of Emerald Isle.</p>	<p>Temporary negative impacts to the Bogue Banks sand spit from dike construction. Indirect positive impacts are anticipated with filling of existing channel and development of sand spit off the west end of Emerald Isle. Negative indirect impacts from the expected erosion of 7,500 feet of ocean shoreline on west end of Emerald Isle. Positive indirect impacts from expected accretion of 7,500 feet of ocean shoreline on east end of Bear Island. Positive cumulative impacts should occur from the restoration of 23,831 feet of ocean shoreline on Emerald Isle with material from Bogue Inlet. Phase 3 would extend into the affected shoreline on the west end of Emerald Isle.</p>	
<b>Supratidal Beach and Dune Communities</b>							
<b>Intertidal Beach</b>	<p>Direct = days to months (during construction) Indirect = 0 to 4 years (4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = after 4 yrs.</p>	<p>Direct negative short-term impacts from the burial of infaunal prey with nourishment material from offshore. Moderate long-term negative impacts depending on compatibility of offshore borrow material.</p>	Same as Alternative A.	Same as Alternative A.	<p>Direct negative short-term impacts from the burial of infaunal prey with nourishment material from Bogue Inlet. Due to compatibility of inlet material with native beach material positive long-term impacts should occur.</p>	Same as Alternative A.	<p>Direct negative short-term impacts from the burial of infaunal prey with nourishment material from Bogue Inlet. Due to compatibility of inlet material with native beach material positive long-term impacts should occur.</p>
<b>Nearshore Soft Bottom (unconsolidated Sediment) Communities</b>	<p>Direct = days Indirect = 0 to 2 years (2 yrs = beach stabilization time) Cumulative = after 2 yrs</p>	<p>Nourishment of Phase 3 shoreline will directly impact nearshore soft bottoms located landward of the 10-foot depth contour and indirectly impact soft bottoms landward of the 20-foot depth contour as the</p>	Same as Alternative A.	Same as Alternative A.	Essentially the same as Alternative A, however, material quality from the inlet would be more compatible with existing nearshore soft bottom communities which should lead to more rapid recovery.	Same as Alternative A.	

		nourishment material migrates offshore.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Nourishment of the beach with material from Bogue Inlet may indirectly impact soft bottoms seaward of the 20 foot depth contour. A void the direct negative impact on 141.5 acres of offshore soft bottom communities.
<b>Offshore Soft Bottom (Unconsolidated Sediment) Communities</b>	Direct = days Indirect = 0 to 2 years (2 yrs = beach and offshore borrow area stabilization time) Cumulative = after 2 yrs	Nourishment of the beach with offshore borrow material may indirectly impact soft bottoms seaward of the 20 foot depth contour. The use of an offshore borrow area will have a direct negative impact on 141.5 acres of offshore soft bottoms.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A; however recovery times should be less due to the compatibility of the inlet material with the native beach material.
<b>Benthic Infaunal Community</b>	Direct = days to months (during construction) Indirect = 1 to 3 years (1 to 3 yrs = infaunal recovery time for medium grain sed.) Cumulative = after 3 yrs.	Direct negative impacts from decreases in infaunal prey densities and abundances for birds and finfish due to direct burial landward of the 10-foot depth contour. Moderate indirect negative impacts due to offshore migration of nourishment material to approximately the 20-foot depth contour.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Similar to Alternative A; however, low silt content of inlet material should result in less turbidity and suspended sediments during the nourishment operation.
<b>Finfish (Beach Resources)</b>	Direct = 0 to 3 days (3 days = est. max settling time of med. grain sed.) Indirect = 6 mos. to 2 and up to 4 years (6 mos to 2 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = after 2 to 4 years	Temporary increase of turbidity and suspended sediments during beach nourishment operation with material from offshore borrow areas.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	
<b>5.6 TURTLE RESOURCES</b>						
<b>5.6.1 Diamondback Terrapin</b>	No associated timeframe	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
	Direct = days to months (during construction) Indirect = 0 to 2 years (2 yrs = beach stabilization time) Cumulative = after 2 yrs.	Negative cumulative impacts from loss of 600 feet of nesting habitat on the west end of Emerald Isle, continued erosion of the inlet shoreline which could result in a breach of the sand spit, and erosion of the eastern 7,500 feet of Bear Island.	Same as Alternative A.	Negative cumulative impacts from loss of 240 feet of nesting habitat on the west end of Emerald Isle, continued erosion of the inlet shoreline which could result in a breach of the sand spit, and erosion of the eastern 7,500 feet of Bear Island.	Negative cumulative impacts due to erosion of western 7,500 feet of Emerald Isle. Positive cumulative impacts to 23,831 feet of shoreline included in Phase 3 nourishment with offshore borrow material. Phase 3 would extend	Negative cumulative impacts due to erosion of western 7,500 feet of Emerald Isle. Positive cumulative impacts to 23,831 feet of shoreline included in Phase 3 nourishment with material from Bogue Inlet. Phase 3 would
<b>5.6.2 Sea Turtle Nesting Habitat</b>						





<p><b>5.7.2 Colonial Waterbirds</b></p>	<p>Direct = days to months (during construction) Indirect = 0 to 4 years (4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = after 4 yrs</p>	<p>Impacts from the erosion of nesting, foraging, and roosting habitats on the Bogue Banks sand spit and Dudley Island. However, impacts would be insignificant as inlet environment is normally highly dynamic. Direct negative impacts from noise and other factors associated with channel maintenance. Island 2 appears to be migrating to the west and may eventually disappear. Short-term negative impacts due to Phase 3 nourishment with offshore borrow material.</p>	<p>Same as Alternative A.</p>	<p>Same as Alternative A.</p>	<p>Direct negative impacts from the presence of construction equipment and loss of 50 acres in infaunal prey habitat in new channel area. Negative short-term impacts due to dike construction and stockpiling of material. Positive cumulative impacts are anticipated from filling of existing channel and relatively rapid development of the sand spit off the west end of Emerald Isle. Positive short term impacts on Dudley Island until sand spit reforms in about 2 years. Island 2 appears to be migrating to the west and may eventually disappear. Direct negative impacts from noise and other factors associated with channel maintenance once this activity resumes. Short-term negative impacts are possible due to Phase 3 nourishment with offshore borrow material.</p>	<p>Direct negative impacts from the presence of construction equipment and loss of 50 acres in infaunal prey habitat in new channel area. Positive cumulative impacts are anticipated from the development of the sand spit off the west end of Emerald Isle. Positive short term impacts on Dudley Island until sand spit reforms in about 4 to 6 years. Island 2 appears to be migrating to the west and may eventually disappear. Direct negative impacts from noise and other factors associated with channel maintenance once this activity resumes. Short-term negative impacts are possible due to Phase 3 nourishment with inlet material.</p>
<p><b>5.7.3 Other Waterbirds</b></p>	<p>Direct = days to months (during construction) Indirect = 0 to 4 years (4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = after 4 yrs</p>	<p>Impacts from the erosion of nesting, foraging, and roosting habitats on the Bogue Banks sand spit and Dudley Island could occur. However, impacts would be insignificant as inlet environment is normally highly dynamic. Direct negative impacts from noise and other factors associated with channel maintenance. Island 2 appears to be migrating to the west and may eventually disappear. Short-term negative impacts due to Phase 3 nourishment with offshore borrow material</p>	<p>Same as Alternative A.</p>	<p>Same as Alternative A.</p>	<p>Direct negative impacts from the presence of construction equipment and loss of 50 acres in infaunal prey habitat in new channel area. Negative short-term impacts due to dike construction and stockpiling of material. Positive cumulative impacts are anticipated from filling of existing channel and relatively rapid development of the sand spit off the west end of Emerald Isle. Positive short term impacts on Dudley Island until sand spit reforms in about 2 years. Island 2 appears to be migrating to the west and may eventually</p>	<p>Direct negative impacts from the presence of construction equipment and loss of 50 acres in infaunal prey habitat in new channel area. Short-term negative impacts due to Phase 3 nourishment with inlet material. Positive cumulative impacts are anticipated from the development of the sand spit off the west end of Emerald Isle. Positive short term impacts on Dudley Island until sand spit reforms in about 4 years. Island 2 appears to be migrating to the west and may eventually</p>

						be migrating to the west and may eventually disappear. Direct negative impacts from noise and other factors associated with channel maintenance once this activity resumes. Short-term negative impacts due to Phase 3 nourishment with offshore borrow material.	disappear. Direct negative impacts may occur from noise and other factors associated with channel maintenance once this activity resumes.
5.8 WATER QUALITY							
5.8.1 Turbidity	Direct = 0 to 3 days (during construction) (3 days = approx. settling time for med. grained sed.) Indirect = 0 years Cumulative = 0 years	Direct short-term increases in turbidity due to construction of Phase 3 beach fill from an offshore borrow area. No apparent significant impact on turbidity in the inlet should occur due to continued maintenance of the inlet channel. Annual maintenance has involved the disposal of between 100,000 and 600,000 cy of material into the open waters of Bogue Inlet.	Same as Alternative A.	Same as Alternative A.		Temporary negative impacts during dredging of the new channel, construction of the sand dike, and filling of the existing channel with stockpiled material. Direct short-term increases in turbidity due to construction of Phase 3 beach fill from an offshore borrow area. No apparent significant impact on turbidity in the inlet due to a resumption of inlet channel maintenance 1 to 2 years following channel relocation. Annual maintenance has involved the disposal of between 100,000 and 600,000 cy of material into the open waters of Bogue Inlet. Construction of the new channel will suspend channel maintenance for 1 to 2 years.	Temporary negative impacts during dredging of the new channel and construction of the sand dike. Direct short-term increases in turbidity due to construction of Phase 3 beach fill with the inlet material, however, turbidity should be low due to low silt content in inlet material. No apparent significant impact on turbidity in the inlet due to a resumption of inlet channel maintenance 1 to 2 years following channel relocation. Annual maintenance has involved the disposal of between 100,000 and 600,000 cy of material into the open waters of Bogue Inlet. Construction of the new channel will suspend channel maintenance for 1 to 2 years.
5.8.2 Salinity	Direct = 0 to 3 days (during construction) (3 days = approx. settling time for med. grained sed.) Indirect = 1 to 2 months Cumulative = after 2 months	Direct, indirect, and cumulative impacts associated with the possible breach of the Bogue Banks sand spit which would provide a direct connection between the inlet and the old Coast Guard channel.	Same as Alternative A.	Same as Alternative A.		Construction of the new channel and closure of the existing channel will temporarily decrease the cross-sectional area of Bogue Inlet. This could reduce the tidal prism for 4 to 6 weeks. Cross-sectional area of inlet will return to its equilibrium size and the tidal prism would be restored to	Construction of the new channel and construction of the sand dike across the existing channel will temporarily decrease the cross-sectional area of Bogue Inlet. This could reduce the tidal prism for 4 to 6 weeks. Cross-sectional area of inlet will return to its equilibrium size and the tidal prism would be restored to

<b>5.9 AIR QUALITY</b>	No associated timeframe.	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	normal within 6 weeks of construction.	would be restored to normal within 6 weeks of construction.	
<b>5.10 PUBLIC SAFETY</b>	Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = 10 years or greater	Direct, indirect, and cumulative impacts associated with the loss of 36 to 51 homes. The damage to roads in the Pointe subdivision could create hazards to vehicular traffic. Public water system would have to be repaired and rerouted in response to continuing erosion of inlet shoreline. This may require boiling of water following each disruption. Individual septic systems would be exposed and have to be removed with possible spillage into adjacent waterways.	Same as Alternative A.	Direct, indirect, and cumulative impacts associated with the loss of 23 homes. The damage to roads in the Pointe subdivision could create hazards to vehicular traffic. Public water system would have to be repaired and rerouted in response to continuing erosion of inlet shoreline. The use of sandbags should provide the town with more response time to reroute waterlines and remove threatened septic systems, however, boiling of water may still be required following each disruption.	Insignificant	Insignificant	Insignificant	Insignificant	Impacts associated with the continued eastward migration of the inlet channel would be eliminated. Erosion of the western 7,500 feet of Emerald Isle would expose homes in this area to a higher degree of risk from coastal storms; however, the level of protection remaining should be sufficient to prevent damage except during the most severe events (Category 4 or 5 hurricanes). Also, a portion of the affected shoreline would be included in the Phase 3 nourishment project.
<b>5.11 AESTHETIC RESOURCES</b>	Direct = 1 to 6 mos. (during construction) Indirect = up to 2 years. Cumulative = 10 years	Regular channel maintenance could distract from natural scenery. Construction activities associated with nourishing the Phase 3 shoreline may distract from the natural scenery. Material from offshore borrow area used to nourish Phase 3 would temporarily (up to 6 mos) be darker than the native material. Erosion of the inlet shoreline would continue to result in unsightly vertical erosion scarps.	Same as Alternative A.	Regular channel maintenance could distract from natural scenery. Construction activities associated with nourishing the Phase 3 shoreline may distract from the natural scenery. Material from offshore borrow area used to nourish Phase 3 would temporarily (up to 6 mos) be darker than the native material. The sandbag revetments would distract from the natural setting.	Insignificant	Insignificant	Insignificant	Insignificant	Resumption of regular channel maintenance 1 to 2 years following channel relocation could distract from natural scenery. Construction activities associated with nourishing the Phase 3 shoreline would distract from the natural scenery. Material from Bogue Inlet used to nourish Phase 3 would temporarily (up to 6 mos) be darker than the native material. Positive long-term impacts on the inlet shoreline aesthetics as channel fill and sand spit development assume more natural characteristics.
<b>5.12 RECREATIONAL RESOURCES</b>	Direct = days to months Months = beach stabilization time) Indirect = up to 2 yrs. Cumulative = > 2 yrs.	Direct, indirect, and cumulative negative impacts to beachgoers from shellhash accumulation in the nearshore zone. Access to the Emerald Isle inlet	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Direct, indirect, and cumulative negative impacts to beachgoers for shellhash accumulation in the nearshore zone. Public access to the Emerald Isle inlet	Direct, indirect, and cumulative negative impacts to beachgoers for shellhash accumulation in the nearshore zone. Public access to the Emerald Isle inlet	Positive direct, indirect, and cumulative impacts from use of inlet material for beach nourishment. Public access to the Emerald Isle inlet shoreline would be	

		shoreline would continue to be restricted.			shoreline would be restored.	restored.
<b>5.13 NAVIGATION</b>	Direct = days to months (during construction) Indirect = 3 to 6 months (3 to 6 months = stabilization of channel depths) Cumulative = > 12 months	No change from existing conditions in Bogue Inlet and connecting channel.	Same as Alternative A.	Same as Alternative A.	Short-term improvement in navigability of inlet channel for 1 to 2 years following channel construction. Channel depths beyond 2 years would be the same as under existing conditions. Temporary disruption of navigation for 30 days due to construction of sand dike and remarking of navigation channel.	Short-term improvement in navigability of inlet channel for 1 to 2 years following channel construction. Channel depths beyond 2 years would be the same as under existing conditions. Temporary disruption of navigation for 30 days due to construction of sand dike and remarking of navigation channel.
<b>5.14 HISTORIC PROPERTIES AND CULTURAL RESOURCES</b>	Direct = days to months Indirect = no associated timeframe Cumulative = indefinite	No cumulative impacts on cultural resources are expected.	Same as Alternative A.	Same as Alternative A.	Anomaly located in existing channel is in an area that would be covered by the sand dike, therefore, no significant impact.	Anomaly located in existing channel is in an area that would be covered by the sand dike, therefore, no significant impact.
<b>5.15 SOCIO-ECONOMIC</b>	Direct = days to months Indirect = 6 mos to 2 and up to 4 years (6 mos to 2 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 years	Direct and indirect negative impacts could occur due to the loss of seven homes following removal of existing sandbags. Cumulative negative impacts may result from erosion of inlet shoreline. Cumulative long-term impacts could occur from protection provided by Phase 3 beach fill.	Same as Alternative A.	Same as Alternative A.	Cumulative long-term impacts may occur from protection provided by Phase 3 beach fill and prevention of losses associated with erosion of inlet shoreline. Cumulative positive impacts from restoration of public access to inlet shoreline.	Cumulative long-term impacts may occur from protection provided by Phase 3 beach fill.
<b>5.16 LAND USE</b>	Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = 10 yrs or greater	Direct, indirect, and cumulative negative effects may occur from the loss of available land and change in land use.	Same as Alternative A.	Same as Alternative A.	Direct, indirect, and cumulative positive effects from preservation of homes and increased beach and recreational access to the Emerald Isle inlet shoreline. The Town of Emerald Isle has initiated efforts to obtain any new land that accretes to implement a bird management plan.	Same as Alternative E.
<b>5.17 HYDRODYNAMICS</b>						
<b>Tides and Flow</b>	Direct = days to months (during construction) Indirect = 3 to 6 mos following channel construction Cumulative = > 6 mos.	No change in existing conditions unless a breach occurs in sand spit connecting Bogue Inlet with the old Coast Guard channel, flow patterns	Same as Alternative A.	Same as Alternative A.	Direct negative impacts from filling of existing channel and opening of new channel. Indirect impacts from scouring of new channel. Cumulative	Direct negative impacts from construction of sand dike and opening of new channel. Indirect impacts from scouring of new channel. Cumulative

		would change but not the overall tidal exchange through the inlet.				Cumulative positive impacts may occur if the tidal flow regime is restored.	positive impacts may occur if the tidal flow regime is restored.
<b>Waves</b>	Direct = days to 2 months (during construction) Indirect = 4 to 6 years (4 to 6 years timeframe for ebb tide delta to adjust to new channel position. Cumulative = 15 to 35 yrs. = est. timeframe for life of new channel location	Direct positive impacts from accretion of western end of Emerald Isle protected by the migrating ebb tide delta. Direct negative impacts from erosion of eastern 7,500 feet on Bear Island.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Indirect positive impacts may result from shoreline accretion along the east end of Bear Island due to wave sheltering by ebb tide delta. Indirect negative impacts due to higher degree of wave exposure on west end of Emerald Isle.	Indirect positive impacts may result from shoreline accretion along the east end of Bear Island due to wave sheltering by ebb tide delta. Indirect negative impacts due to higher degree of wave exposure on west end of Emerald Isle.
<b>Littoral Transport</b>	Direct = days to 2 months (during construction) Indirect = 4 to 6 years (4 to 6 years timeframe for ebb tide delta to adjust to new channel position. Cumulative = 15 to 35 yrs. = est. timeframe for life of new channel location	No change in normal rates of littoral transport except along the extreme west end of the Phase 3 beach fill. Sediment transport rates off the west end of the fill will likely be greater than normal rates; however, the increased sediment transport rates will not extend to the inlet.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Net sediment transport rates along the extreme west end of Emerald Isle will gradually increase from its present value near 0 to a rate comparable to that which occurs east of the area influenced by the existing ebb tide delta. Since the Phase 3 fill ends 4,500 feet from the inlet, sediment transport rates of the west terminus of the Phase 3 fill should not be impacted. Filling of the existing channel will accelerate the rate of spit development with the spit reaching the sand dike in about 2 years.	Net sediment transport rates along the extreme west end of Emerald Isle should gradually increase from its present value near 0 to a rate comparable to that which occurs east of the area influenced by the existing ebb tide delta. Since the Phase 3 fill ends 4,500 feet from the inlet, sediment transport rates of the west terminus of the Phase 3 fill should not be impacted. Sediment transport into the inlet will be intercepted by the existing channel until the channel is filled. This should slow the rate of spit development with the spit reaching the sand dike in about 4 to 6 years.
<b>5.18 INFRASTRUCTURE</b>	Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = >10 years	Cumulative negative impacts from repeated responses to disconnect and reroute utility services (water, electrical, etc.) and remove septic systems. Temporary access roads would have to be constructed to reach isolated homes.	Same as Alternative A.	Essentially the same as Alternative A; however, sandbags would reduce the magnitude of the impact on infrastructure.	Positive cumulative impacts from prevention of loss of infrastructure in the Pointe subdivision. Potential negative long-term impacts should erosion of the ocean shoreline exceed predicted adjustments.	Positive cumulative impacts from prevention of loss of infrastructure in the Pointe subdivision. Potential negative long-term impacts should erosion of the ocean shoreline exceed predicted adjustments.	Positive cumulative impacts from prevention of loss of infrastructure in the Pointe subdivision. Potential negative long-term impacts should erosion of the ocean shoreline exceed predicted adjustments.
<b>5.19 WATER COLUMN</b>	Direct = 0 to 3 days (3 days = estm max	Direct negative impacts due to increased turbidity	Same as Alternative A.	Same as Alternative A.	Direct negative impacts during channel	Direct negative impacts during channel and dike	Direct negative impacts during channel and dike

5.19.1 <b>Marine</b>	<p>settling time of med. grain sed.) Indirect = 6 mos to 2 and up to 4 yrs. (6 mos. To 2 yrs = beach stabilization time; 4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 yrs.</p>	<p>during maintenance dredging and beach nourishment activities.</p>			<p>construction, dike construction, stockpiling of channel material, and filling of existing channel. Direct negative impacts from increased turbidity during beach nourishment activities.</p>	<p>construction. Direct negative impacts from increased turbidity during beach nourishment activities.</p>
5.19.2 <b>Estuarine</b>	<p>Direct = 0 to 3 days (3 days = estm max settling time of med. grain sed.) Indirect = 6 mos to 2 and up to 4 yrs. (6 mos. To 2 yrs = beach stabilization time; 4 yrs = time for sand spit to merge with sand dike under Alternative F) Cumulative = 2 to 4 yrs.</p>	<p>Minor direct negative impacts due to increased turbidity during maintenance dredging. Impacts on estuarine resources minor due to low suspension time and transport distances for suspended sediment.</p>	Same as Alternative A.	Same as Alternative A.	<p>Direct negative impacts during channel construction, dike construction, stockpiling of channel material, and filling of existing channel. However, due to low suspension time and travel distance of suspended sediment, impacts on estuarine resources should be minor. Indirect impacts would occur as the new channel scours in response to the tidal flow through Bogue Inlet. Material scoured from the channel will move as bed load along the bottom of the Eastern and Western Channels and should not accumulate above mean high water.</p>	<p>Direct negative impacts during channel and dike construction. However, due to low suspension time and travel distance of suspended sediment, impacts on estuarine resources should be minor. Indirect impacts would occur as the new channel scours in response to the tidal flow through Bogue Inlet. Material scoured from the channel will move as bed load along the bottom of the Eastern and Western Channels and should not accumulate above mean high water.</p>
5.20 <b>URBAN QUALITY</b>	<p>Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = &gt;10 years</p>	<p>Direct and indirect negative impacts could result from continued erosion of The Pointe shoreline and demolition of structures. Cumulative negative impacts from decreased storm protection in the Pointe subdivision.</p>	Same as Alternative A.	Same as Alternative A.	<p>Short-term direct negative impacts due to presence of dredging equipment. Indirect and cumulative positive impacts should result as an increase in property values. Indirect and cumulative negative impacts from erosion of the western 7,500 feet of Emerald Isle. Partial mitigation of the erosion by Phase 3 beach nourishment project.</p>	<p>Short-term direct negative impacts due to presence of dredging equipment. Indirect and cumulative positive impacts should result as an increase in property values. Indirect and cumulative negative impacts from erosion of the western 7,500 feet of Emerald Isle. Partial mitigation of the erosion by Phase 3 beach nourishment project.</p>
5.21 <b>SOLID WASTE</b>	<p>Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = &gt;10 years</p>	<p>Direct, indirect, and cumulative negative impacts on landfills could result from the debris produced by the</p>	<p>Direct, indirect, and cumulative negative impacts on landfills could result from the debris produced by the</p>	<p>Direct, indirect, and cumulative negative impacts on landfills could result from the debris produced by the</p>	<p>No negative impacts.</p>	<p>No negative impacts.</p>

		demolition of at least 36 structures, 1,640 feet of roads and associated utilities.	demolition of concrete pads and driveways of the relocated 36 structures, 1,640 feet of roads and associated utilities.	demolition of at least 23 structures, 890 feet of roads and associated utilities, and sandbag removal.		
5.22 DRINKING WATER	Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = >10 years	Direct, indirect, and cumulative negative impacts could result from disconnecting and rerouting potable water lines within the Pointe subdivision. Property owners would have to boil water after each such incident.	Same as Alternative A.	Similar to Alternative A; however the numbers of service interruptions and the need to reroute waterlines would be reduced.	No negative impacts	No negative impacts
	Direct = 0 to 5 years Indirect = 5 to 10 years Cumulative = >10 years	Negative direct, indirect, and cumulative impacts due to loss of 36 structures, 1,640 feet of roads and utilities, loss of tax revenues, and reduction in household spending. Economic impact would range from \$1.9 million in year 2 to \$14.6 million in year 10. Town of Emerald Isle would nourish Phase 3 from using an offshore borrow area at a cost of about \$5.8 million.	Negative direct, indirect, and cumulative impacts due to the cost of relocating 36 structures to other areas in Emerald Isle, the loss of 1,640 feet of roads and utilities, and a reduction of tax revenues for lots lost to erosion. Economic impact would range from \$1.9 million in year 2 to \$14.6 million in year 10. Town of Emerald Isle would nourish Phase 3 from using an offshore borrow area at a cost of about \$5.8 million.	Negative direct, indirect, and cumulative impacts due to loss of 23 structures, 890 feet of roads and utilities, loss of tax revenues, reduction in household spending, and installation, maintenance, and removal costs for sandbag revetments. Economic impact would range from \$1.9 million in year 2 to \$14.6 million in year 10. Town of Emerald Isle would nourish Phase 3 from using an offshore borrow area at a cost of about \$5.8 million.	Positive direct, indirect, and cumulative impacts from the possible protection of threatened homes and infrastructure in the Pointe subdivision for at least 15 years and for at least 15 years and possibly 35 years. Cost of project would deplete Town of Emerald Isle's funds available for beach nourishment. Negative direct impact on Town of Emerald Isle as nourishment of the Phase 3 shoreline from an offshore borrow area would still be needed. Emerald Isle would probably need a new bond referendum.	Positive direct, indirect, and cumulative impacts from the possible protection of threatened homes and infrastructure in the Pointe subdivision for at least 15 years and for at least 15 years and possibly 35 years. Positive direct impacts from use of inlet material to nourish the 23,831 feet of shoreline included in Phase 3.
5.23 ECONOMICS						
PROJECT GOALS AND OBJECTIVES						
Short-term protection of 7 homes and infrastructure.	For 0 to 5 years	No. Seven homes and portions of Inlet Drive and Bogue Court would be lost during the next 2 years.	No. Seven homes would be removed from the Pointe subdivision during the next 2 years and portions of Inlet Drive and Bogue Court would be lost.	No. NC coastal regulations would require the removal of the existing 700-foot long sandbag revetment resulting in the loss of the 7 structures and portions of Inlet Drive and Bogue Court.	Yes. Inlet shoreline erosion would be controlled and inlet shoreline would build to the west in the form of a sand spit.	Yes. Inlet shoreline erosion would be controlled and inlet shoreline would build to the west in the form of a sand spit.
	For 15 to 35 years	No. Over a 10 year period at least 36 homes would be lost along with 1,640 feet of roads within the Pointe subdivision.	No. Over a 10 year period at least 36 homes would be relocated from the Pointe subdivision to other areas of Emerald Isle and 1,640 feet of	No. Over a 10 year period at least 23 homes would be lost and 890 feet of roads within the Pointe subdivision would be lost.	Yes. Relocation of the channel should provide protection to the Pointe subdivision for a minimum of 15 years and a maximum of 35 years.	Yes. Relocation of the channel should provide protection to the Pointe subdivision for a minimum of 15 years and a maximum of 35 years.

			roads within the Pointe subdivision would be lost.						
<b>Eliminate or reduce erosion rates along the Pointe shoreline.</b>	For 15 to 35 years	No. Erosion of the Pointe shoreline would continue.	No. Erosion of the Pointe shoreline would continue.	No. The sandbag revetments would slow but not eliminate erosion of the Pointe shoreline.	Yes. Erosion of the Pointe shoreline would be eliminated for a period of at least 15 years and possibly 35 years.	Yes. Erosion of the Pointe shoreline would be eliminated for a period of at least 15 years and possibly 35 years.			
<b>Reestablish public access to the inlet shoreline.</b>	For 15 to 35 years	No. Continued erosion of the inlet shoreline would prevent the establishment of a public access with parking.	No. Continued erosion of the inlet shoreline would prevent the establishment of a public access with parking.	No. Continued erosion of the Pointe shoreline and the construction of sandbag revetments would prevent the establishment of a public access with parking.	Yes. The filling of the existing channel would allow the reestablishment of public access with parking within 1 to 2 years following channel relocation.	Yes. Public access could be established within 2 to 4 years of channel relocation or until the sand spit develops sufficiently to provide the land area necessary to accommodate the public access and parking. During the interim, public access could be hampered by the continued existence of sandbags protecting the 7 threatened homes.			
<b>Improve recreational opportunities along ocean shoreline.</b>	For 5 to 10	Partially. The improved recreational opportunities will depend on the quality of material from the offshore borrow areas. Previous nourishment operations from these offshore sources have had high shell content which has had some negative impacts on beach use.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Yes. The inlet material, which would be used to construct the beach fill along the 23,831 feet of shoreline included in Phase 3, is completely compatible with the native beach and has a low (less than 5%) shell content.			
<b>Acquisition of beach compatible material for shore protection project.</b>	No associated timeframe	Partially. The offshore borrow material does not appear to have any significant negative impacts on beach organisms, plants, or nesting sea turtles; however, beach use has been affected due to the high shell content.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Yes. The inlet material, which was derived from the adjacent beaches, is completely compatible with the native beach material.			
	For 10 to 35 years	No. The inlet shoreline would continue to erode and could lead to the possible breach of the Bogue Banks sand spit. A breach of the sand spit could result in the spit evolving into an overwash terrace with	Same as Alternative A.	No. In spite of the sandbag revetments that would slow erosion of the Pointe shoreline and protect threatened homes and infrastructure, the Bogue Banks sand spit would continue to erode. This could result a	Yes. The relocation of the channel and filling of the existing channel should restore the inlet habitat within 2 years after construction. The recovery time would be impacted by the stockpiling of material on	Yes. The time required for the inlet habitat to assume natural characteristics could be 4 to 6 years as the sand spit develops off the west end of Emerald Isle. The ocean beach habitat would be restored to			



<b>Restoration of beach and inlet habitats.</b>		completely different environmental characteristics compared to historic conditions. Except for possible negative impacts to human use of the ocean shoreline, the offshore material should provide suitable beach habitat for the ocean shoreline.	possible breach of the Bogue Banks sand spit. A breach of the sand spit could result in the spit evolving into an overwash terrace with completely different environmental characteristics compared to historic conditions. Except for possible negative impacts to human use of the ocean shoreline, the offshore material should provide suitable beach habitat for the ocean shoreline.	the sand spit and inlet shoals. Except for possible negative impacts to human use of the ocean shoreline, the offshore material should provide suitable beach habitat for the ocean shoreline.	natural conditions within 6 months to 12 months following the nourishment operation using the material from Bogue Inlet.
<b>Maintain Town's tax base.</b>	For 15 to 35 years	No. The present worth of tax revenues collected by Emerald Isle and Carteret County would continually decline over the 10-year economic analysis period. Total town and county tax revenues would decrease by \$5,900 in year 1 to over \$337,000 in year 10.	No. The present worth of tax revenues collected by Emerald Isle and Carteret County would continually decline over the 10-year economic analysis period. Total town and county tax revenues would decrease by \$2,400 in year 1 to over \$191,000 in year 10.	Yes. However, the Town of Emerald Isle would use all of the funds available from its exiting bond referendum to relocate the channel and fill the existing channel. This would probably require the town to request another bond referendum to support completion of Phase 3 of the beach nourishment project. This could result in an increase in the Town's tax rate.	Yes.

**TABLE 24**  
**LIST OF PREPARERS**

Name/Affiliation	Discipline/Expertise	Role in EIS Preparation	Experience
Tom Jarrett, P.E. Coastal Planning & Engineering, Inc.	Senior Coastal Engineer	Project Manager	34 years, Coastal Engineering with ACOE; 2 years, Coastal Planning & Engineering
Craig J. Kruempel Coastal Planning & Engineering, Inc.	Coastal Zone Management/ Marine Biology NEPA Compliance	Senior Project Scientist	16 years, Coastal Planning & Engineering
Bill Cleary, Ph.D. University of North Carolina, Wilmington	Marine and Coastal Geologist	Conducted Historical Shoreline Change Analysis of Bogue Inlet	UNCW Professor and research scientist
Erin A. Haight Coastal Planning & Engineering, Inc.	Environmental Scientist Permitting and Compliance	Principal Project Scientist	4 years, USGS; 2 years, Massachusetts DOT; 2 years, EarthTech; 1.5 years, Coastal Planning & Engineering
Melissa V. Green Coastal Planning & Engineering, Inc.	Marine Biologist	Project Scientist	10 mos., Coastal Planning & Engineering
Angela M. Belden Coastal Planning & Engineering, Inc.	Director GIS/CAD Operations	Principal GIS/CAD Developer	3 years, PSNH; 2 years George Keller Surveyors; 13 years Coastal Planning & Engineering
David N. Rubin Coastal Planning & Engineering, Inc.	GIS Specialist	GIS/CAD Development	3 years, Amec Earth Environmental; 6 mos. Coastal Planning & Engineering
Frank Rush Town of Emerald Isle, NC	Town of Emerald Isle	Applicant / Product Reviewer	Project Coordinator for Town of Emerald Isle
Mayor Art Schools Town of Emerald Isle, NC	Town of Emerald Isle	Product Reviewer	Town Representative
Mickey Sugg U.S. Army Corps of Engineers - Wilmington District	NEPA Compliance	USACE Project Manager	Project Coordinator / Product Reviewer
Tere Barrett N.C. Division of Coastal Management	SEPA Compliance	NCDCM Project Manager	Project Coordinator / Product Reviewer